EL195DF SERIES UNITS

EL195DF series units are high-efficiency gas furnaces manufactured with Lennox DuralokPlus™ aluminized steel clamshell-type heat exchangers, with a stainless steel condensing coil. EL195DF units are available in heating input capacities of 44,000 to 110,000 Btuh (13 to 32.2 kW) and cooling applications from 2 through 5 tons (7.0 through 17.6 kW). Refer to Engineering Handbook for proper sizing.

Units are factory equipped for use with natural gas. A kit is available for conversion to LP/Propane operation. All EL195DF units are equipped with a hot surface ignition system. The gas valve is redundant to assure safety shut-off as required by C.S.A.

The heat exchanger, burners and manifold assembly can be removed for inspection and service. The maintenance section gives a detailed description on how this is done.

All specifications are subject to change. Procedures outlined in this manual are presented as a recommendation only and do not supersede or replace local or state codes.

⚠WARNING

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

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⚠WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional installer (or equivalent), service agency or the gas supplier.

⚠ WARNING

Sharp edges.
Be careful when servicing unit to avoid sharp edges which may result in personal injury.

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SPECIFICATIONS

	Model No.	EL195DF045P36B	EL195DF070P48B	EL195DF090P60C	EL195DF110P60C
Gas Heating Performance	[1] AFUE	95%	95%	95%	95%
	Input - Btuh	44,000	66,000	88,000	110,000
	Output - Btuh	42,000	64,000	85,000	106,000
	Temperature rise range - °F	25 - 55	25 - 55	30 - 60	40 - 70
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10	3.5 / 10	3.5 / 10	3.5 / 10
	High static - in. w.g.	0.5	0.5	0.5	0.5
Connections in.	Intake / Exhaust Pipe (PVC)	2 / 2	2 / 2	2 / 2	2 / 2
	Gas pipe size IPS	1/2	1/2	1/2	1/2
	Condensate Drain Trap (PVC pipe) - i.d.	1/2	1/2	1/2	1/2
	with furnished 90° street elbow	1/2 slip x 1/2 Mipt	1/2 slip x 1/2 Mipt	1/2 slip x 1/2 Mipt	1/2 slip x 1/2 Mipt
	with field supplied (PVC coupling) - o.d.	1/2 slip x 1/2 Npt	1/2 slip x 1/2 Npt	1/2 slip x 1/2 Npt	1/2 slip x 1/2 Npt
Indoor Blower	Wheel nom. dia. x width - in.	10 x 8	11-1/2 x 10	11-1/2 x 10	11-1/2 x 10
	Motor output - hp	1/3	3/4	1	1
	Tons of add-on cooling	2 - 3	3 - 4	4 - 5	4 - 5
	Air Volume Range - cfm	605-1615	1090-1885	1270-2305	1330-2375
Electrical Data	Voltage	120 volts - 60 hertz - 1 phase			
	Blower motor full load amps	6.1	10.0	11.5	11.5
	Maximum overcurrent protection	12	12	15	15
Shipping Data	lbs. - 1 package	121	134	154	164

NOTE - Filters and provisions for mounting are not furnished and must be field provided.

[1] Annual Fuel Utilization Efficiency based on DOE test procedures and according to FTC labeling regulations. Isolated combustion system rating for non-weatherized furnaces.

OPTIONAL ACCESSORIES - MUST BE ORDERED EXTRA

			"B" Width Models	"C" Width Models
CABINET ACCESSORIES				
Downflow Combustible Flooring Base			**11M60**	**11M61**
CONDENSATE DRAIN KITS				
Condensate Drain Heat Cable		6 ft.	**26K68**	**26K68**
		24 ft.	**26K69**	**26K69**
		50 ft.	**26K70**	**26K70**
Heat Cable Tape	Fiberglass - 1/2 in. x 66 ft.		**36G53**	**36G53**
	Aluminum foil - 2 in. x 60 ft.		**16P89**	**16P89**
Crawl Space Vent Drain Kit			**51W18**	**51W18**
CONTROLS				
DOWNFLOW FILTER KITS				
Downflow Air Filter and Rack Kit			**51W07**	**51W08**
	No. and Size of filter - in.		(2) 20 x 20 x 1	(2) 20 x 20 x 1
NIGHT SERVICE KITS				
Night Service Kit			**51W03**	**51W03**
Safety Service Kit			**89W20**	**89W20**
TERMINATION KITS				
See Installation Instructions for specific venting information.				
Termination Kits - Direct Vent Applications Only	Concentric	US - 2 in.	**71M80**	**69M29**
		3 in.	**- - -**	**60L46**
		Canada - 2 in.	**44W92**	**44W92**
		3 in.	**- - -**	**44W93**
	Flush-Mount	2, 2-1/2 or 3 in.	**51W11**	**51W11**
	Wall - Close Couple	US - 2 in.	**22G44**	**- - -**
		3 in.	**44J40**	**44J40**
	Wall - Close Couple WTK	Canada - 2 in.	**30G28**	**- - -**
		3 in.	**81J20**	**81J20**
Termination Kits - Direct or Non-Direct vent	Roof	2 in.	**15F75**	**15F75**
	Wall Ring Kit	2 in.	**15F74**	[3] **15F74**
Roof Termination Flashing Kit - Direct or Non-Direct Vent (2 flashings)		2 in.	**44J41**	**44J41**

[1] Cleanable polyurethane frame type filter.

[2] Kits contain enough parts for two, non-direct vent installations.

[3] Non-direct vent only.

NOTE - Termination Kits **44W92**, **44W93**, **30G28**, **81J20** are certified to ULC S636 standard for use in Canada only.

GAS HEAT ACCESSORIES

Input	High Altitude Pressure Switch Kit		Natural Gas to LPG/Propane Kit	LPG/Propane to Natural Gas Kit	Natural Gas High Altitude Orifice Kit	LPG/Propane High Altitude Orifice Kit
	4501 - 7500 ft.	7501 - 10,000 ft.	0 - 7500 ft.	0 - 7500 ft.	7501- 10,000 ft.	7501- 10,000 ft.
045	**No Change**	**74W90**	**69W73**	**73W81**	**73W37**	**68W68**
070	**77W43**	**73W22**	**69W73**	**73W81**	**73W37**	**68W68**
090	**77W43**	**73W22**	**69W73**	**73W81**	**73W37**	**68W68**
110	**77W43**	**73W22**	**69W73**	**73W81**	**73W37**	**68W68**

EL195DF045P36B PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1615	650	1385	555	1205	465	1045	390
0.10	1605	640	1380	545	1195	455	1035	380
0.20	1500	620	1345	525	1165	445	1015	370
0.30	1450	590	1290	490	1125	420	975	365
0.40	1350	560	1235	480	1090	405	920	345
0.50	1300	545	1170	450	1035	380	880	330
0.60	1195	500	1095	425	990	365	840	320
0.70	1140	480	1020	395	895	345	780	300
0.80	1025	450	920	370	840	330	695	270
0.90	945	430	800	335	700	290	605	250

EL195DF070P48B PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1885	935	1830	815	1810	720	1700	640
0.10	1850	910	1805	795	1785	705	1680	630
0.20	1775	890	1750	775	1710	690	1620	610
0.30	1715	870	1685	755	1640	660	1575	595
0.40	1645	855	1620	735	1595	650	1495	575
0.50	1575	835	1525	715	1485	625	1440	555
0.60	1505	815	1450	690	1425	610	1360	540
0.70	1390	790	1360	675	1340	590	1270	525
0.80	1280	770	1270	650	1255	570	1210	505
0.90	1200	740	1185	635	1160	550	1090	485

EL195DF090P60C PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	2305	1255	2145	950	1900	810	1515	670
0.10	2295	1240	2135	940	1885	795	1500	665
0.20	2200	1220	2085	915	1865	775	1525	655
0.30	2160	1210	1990	875	1830	755	1545	640
0.40	2055	1170	1935	865	1790	725	1530	620
0.50	1970	1130	1855	835	1705	700	1500	600
0.60	1890	1105	1765	805	1635	675	1495	580
0.70	1775	1075	1680	785	1565	655	1430	560
0.80	1690	1050	1590	760	1485	630	1370	540
0.90	1580	1010	1485	735	1405	610	1270	510

EL195DF110P60C PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds							
	High		Medium-High		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	2375	1250	2205	915	1975	785	1630	640
0.10	2365	1235	2195	905	1960	775	1625	635
0.20	2275	1200	2125	890	1950	760	1635	625
0.30	2200	1180	2060	880	1900	735	1620	610
0.40	2115	1150	1995	850	1845	710	1620	600
0.50	2040	1115	1940	835	1795	695	1585	580
0.60	1955	1090	1855	810	1745	670	1540	565
0.70	1860	1070	1730	765	1640	650	1515	550
0.80	1735	1030	1620	740	1590	620	1415	535
0.90	1640	1010	1535	715	1480	600	1330	510

PARTS ARRANGEMENT

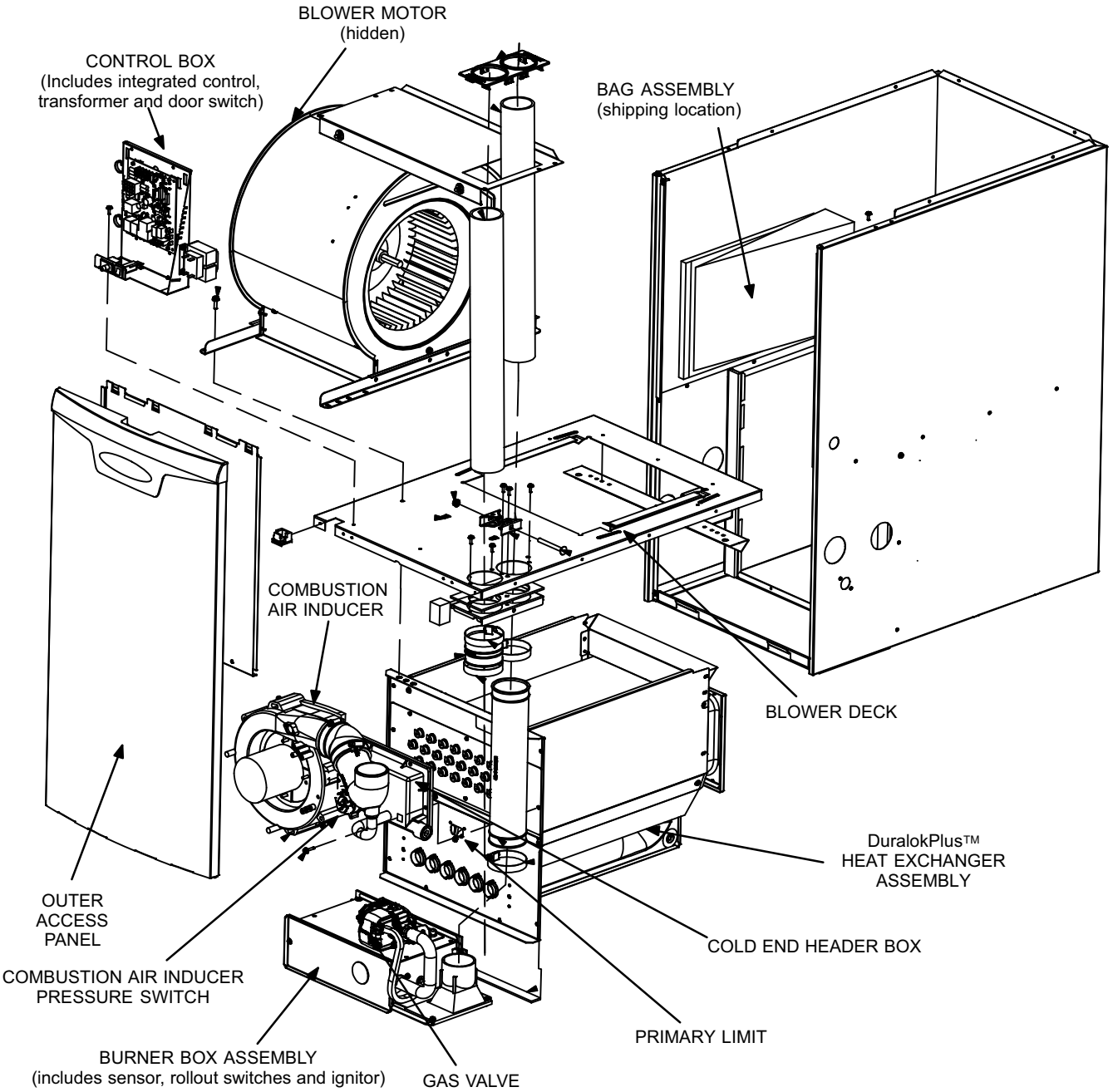


FIGURE 1

I-UNIT COMPONENTS

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions to neutralize electrostatic charge by touching your hand and tools to metal prior to handling the control.

EL195DF unit components are shown in figure 1. The combustion air inducer, gas valve and burners can be accessed by removing the burner access panel. The blower and control box can be accessed by removing the blower access door.

A-Control Box Components (Figure 2)

Unit transformer (T1) and integrated ignition control (A92) are located in the control box. In addition, a door interlock switch (S51) is located in the control box.

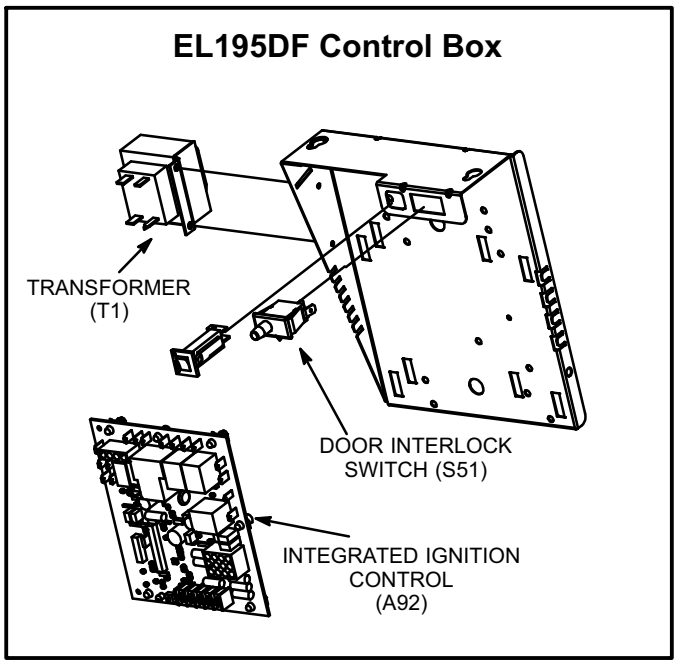


FIGURE 2

1. Transformer (T1)

A transformer located in the control box provides power to the low voltage section of the unit. The transformers on all models are rated at 40VA with a 120V primary and 24V secondary.

2. Door Interlock Switch (S51)

A door interlock switch rated 14A at 120VAC is located on the control box. The switch is wired in series with line voltage. When the blower door is removed the unit will shut down.

3. Integrated Ignition Control (A92)

⚠ WARNING

Shock hazard.
Disconnect power before servicing. Control is not field repairable. If control is inoperable, simply replace entire control.
Can cause injury or death. Unsafe operation will result if repair is attempted.

The ignition control system consists of an integrated control (figure 4) ignitor (figure 5) and flame sensor (figure 5). The integrated control and ignitor work in combination to ensure furnace ignition and ignitor durability. The integrated control, controls all major furnace operations. The integrated control also features a RED LED light for troubleshooting and two accessory terminals rated at (1) one amp. Tables 1 and 2 show jack plug terminal designations. See table 3 for troubleshooting diagnostic codes. The nitride ignitor is made from a non-porous, high strength proprietary ceramic material that provides long life and trouble free maintenance. The integrated control continuously monitors line voltage and maintains the ignitor power at a consistent level to provide proper lighting and maximum ignitor life.

TABLE 1

4-Pin Terminal Designation	
PIN #	**FUNCTION**
1	Combustion Air Inducer Line
2	Ignitor Line
3	Combustion Air Inducer Neutral
4	Ignitor Neutral

TABLE 2

12-Pin Terminal Designations	
PIN #	**FUNCTION**
1	High Limit Output
2	Not Used
3	24V Line
4	Not Used
5	Rollout Switch Out
6	24V Neutral
7	High Limit Input
8	Ground
9	Gas Valve Common
10	Pressure Switch In
11	Rollout Switch In
12	Gas Valve Out

Electronic Ignition

On a call for heat the integrated control monitors the combustion air inducer prove switch. The integrated control will not begin the heating cycle if the pressure switch is closed (by-passed). Once the pressure switch is determined to be open, the combustion air inducer is energized. When the differential in the pressure switch is great enough, the pressure switch closes and a 15-second pre-purge begins. If the pressure switch is not proven within 2-1/2 minutes, the integrated control goes into Watchguard-Pressure Switch mode for a 5-minute re-set period.

After the 15-second pre-purge period, the ignitor warms up for 20 seconds during which the gas valve opens at 19 seconds for a 4-second trial for ignition. The ignitor remains energized for the first 3 seconds during the 4 second trial. If ignition is not proved during the 4-second period, the integrated control will try four more times with an inter purge and warm-up time between trials of 35 seconds. After a total of five trials for ignition (including the initial trial), the integrated control goes into Watchguard-Flame Failure mode. After a 60-minute reset period, the integrated control will begin the ignition sequence again.

The integrated control has an added feature of ignitor power regulation to maintain consistent lighting and longer ignitor life under all line voltage conditions.

Fan Control

Heating Fan On Delay

The heating fan on time of 30 seconds is not adjustable.

Heating Fan Off Delay

The heat fan off delay (amount of time that the blower operates after the heat demand has been satisfied) may be adjusted by changing the jumper position across the five pins on the integrated control. The unit is shipped with a factory fan off setting of 90 seconds. The fan off delay affects comfort and is adjustable to satisfy individual applications. Adjust the fan off delay to achieve a supply air temperature between 90° and 110°F at the moment that the blower is de-energized. Longer off delay settings provide lower return air temperatures; shorter settings provide higher return air temperatures. See figure 3.

Cooling Fan On Delay

The cool fan on delay is 2 seconds and not adjustable.

Cooling Fan Off Delay

The cool fan off delay (amount of time that the blower operates after the cool demand has been satisfied) is 45 seconds and not adjustable.

HEAT FAN-OFF TIME IN SECONDS

JUMPER POSITION		HEAT OFF DELAY
PIN1	PIN2	60
PIN2	PIN3	90
PIN3	PIN4	120
PIN4	PIN5	180
NO JUMPER		180

To adjust fan-off timing, reposition jumper across pins to achieve desired setting.

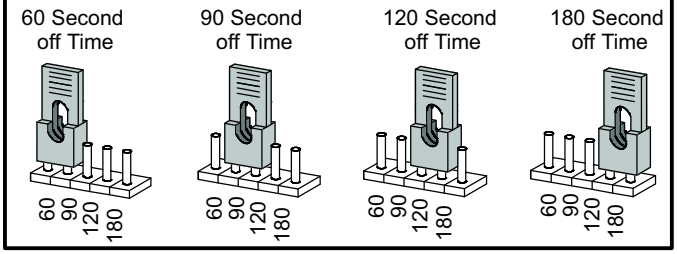
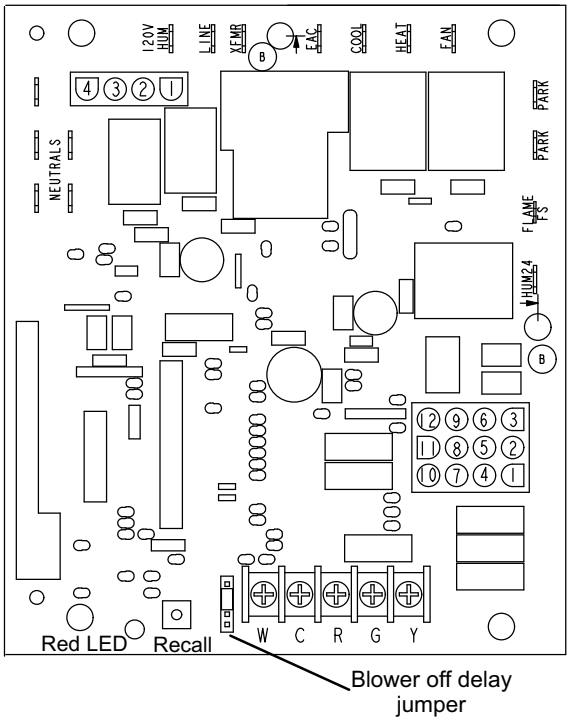

60 Second off Time
90 Second off Time
120 Second off Time
180 Second off Time
60 90 120 180
60 90 120 180
60 90 120 180
60 90 120 180

FIGURE 3

INTEGRATED CONTROL
(Automatic Hot Surface Ignition System)



TERMINAL DESIGNATIONS	
HUM	Humidifier (120VAC)
LINE	Input (120VAC)
XFMR	Transformer (120VAC)
EAC	Indoor Air Quality Accessories (120VAC)
COOL	Blower - Cooling Speed (120VAC)
HEAT	Blower - Heating Speed (120VAC)
PARK	Dead terminals to park alternate speed taps
FLAME	Flame sensor
FAN	Continuous blower
HUM	Humidifier (24VAC)

FIGURE 4

TABLE 3

RED LED Flash Code	Diagnostic Codes / Status of Furnace
Off	No power to control or board fault detected.
ON	Board Fault Detected.
Heartbeat[1]	Control powered - displayed during all modes of operation if no errors are detected.
1	Reverse Line Voltage. Corrective Action - Check the 120V line and neutral connections and reverse the connection if necessary.
2	Improper Earth Ground. Corrective Action - Check for proper unit ground and install if necessary.
3	Burner failed to light, or lost flame during heat demand. Corrective Action - Check condition of flame sensor and clean if necessary using steel wool. Check flame sensor signal and replace if necessary. Check flame sensor wiring and replace if necessary.
4	Low Flame Signal. Corrective Action - Check flame sensor micro amp reading. Normal reading is 1.5. Replace sensor if lower than 0.5.
5	Watchguard - burner failed to light, exceeded maximum number of retries or recycles.
6	Ignitor Circuit Failure - not available on this control.
7	Primary or Secondary Limit Open or Watchguard Mode - Limit Switch Open longer than 3 minutes. Corrective Action Check for restriction on blower inlet air and outlet air. Remove restrictions. Check unit rate, rise and static. Make adjustments if necessary and run unit until equilarium. Check continuity across switch and replace if necessary.
8	Rollout Switch Open. Corrective Action - Check continuity across switch and replace switch if necessary. Check for restriction in vent pipe, combustion air inlet and heat exchanger. Determine cause of restriction before placing furnace back inoperation.
9	Pressure Switch failed to close or opened during heat demand. Corrective Action - Check the differential in the pressure switch. See figure 11. Check for restricted vent pipe and remove all blockage. Check vent pipe sizing. See table 10.
10	Watchguard - Pressure Switch opened 5 times during one heat demand. Corrective Action - Check for restricted vent pipe and remove all blockage. Check the condensate line for proper drainage and correct as necessary. Check for proper vent termination and replace if necessary. See table 8.
11	Pressure Switch stuck closed prior to activation of combustion air inducer. Corrective Action - Check that the pressure switch is open without the combustion air inducer operating. Replace switch if defective.
12	Flame Sensed without gas valve energized. Corrective Action - Check that the gas valve is stuck open. Replace gas valve.
13	Low Line Voltage. Corrective Action - Check line voltage to unit. Voltage should be 120V ± 10%. Contact power company if necessary.
Notes	
Note 1	A ”Heartbeat” is indicated by a ”Slow Flash” - 1 sec on 1 sec off, repeating
Note	Error codes are indicated by a ”Rapid Flash” - the LED flashes X times at 1/2 sec on 1/2 sec off, remains off for 3 sec, then repeats
Note	Last 10 error codes are stored in memory including when power is shut off to the unit. - To recall, press and release button, most recent will be displayed first, LED off for 3 sec, then next error code is displayed, etc. To clear error codes, depress and hold button longer than 5 seconds.

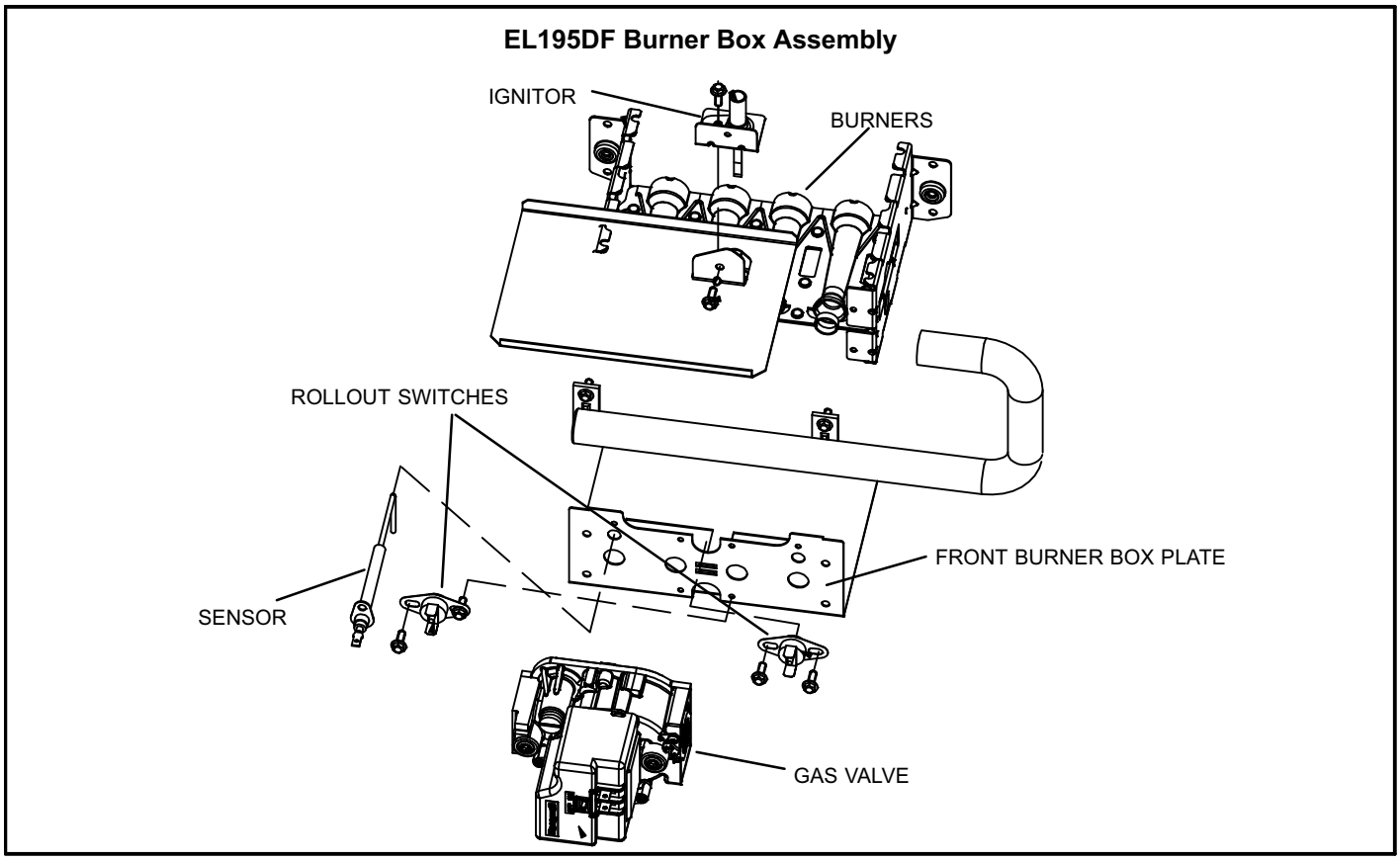


FIGURE 5

B-Heating Components

Combustion air inducer (B6), primary limit control (S10), SureLight ignitor, burners, flame rollout switch (S47), gas valve (GV1), combustion air prove switch (S18), and clamshell heat exchangers are located in the heating compartment. The heating compartment can be accessed by removing the burner access panel.

1. Flame Rollout Switches (Figure 5)

Flame rollout switches S47 are SPST N.C. high temperature limits located on the top left and bottom right of the front buner box plate. S47 is wired to the burner ignition control A92. When either of the switches sense flame rollout (indicating a blockage in the combustion passages), the flame rollout switch trips, and the ignition control immediately closes the gas valve. Switch S47 in all EL195DF units is factory preset to open at 210°F ± 12°F (99°C ± 6.7°C) on a temperature rise. All flame rollout switches are manual reset.

2. Heat Exchanger (Figure 6)

EL195DF units use an aluminized steel primary and stainless steel secondary heat exchanger assembly. Heat is transferred to the air stream from all surfaces of the heat exchanger. The shape of the heat exchanger ensures maximum efficiency.

The combustion air inducer pulls fresh air through the burner box. This air is mixed with gas in the burners. The gas / air mixture is then burned at the entrance of each clamshell. Combustion gases are then pulled through the primary and secondary heat exchangers and exhausted out the exhaust vent pipe.

3. Primary Limit Control (Figure 6)

Primary limit (S10) used on EL195DF units is located in the heating vestibule panel. When excess heat is sensed in the heat exchanger, the limit will open. Once the limit opens, the furnace control energizes the supply air blower and de-energizes the gas valve. The limit automatically resets when unit temperature returns to normal. The switch is factory set and cannot be adjusted. For limit replacement remove wires from limit terminals and rotate limit switch 90 degrees. Slowly remove from the vestibule panel. Install replacement limit with same care.

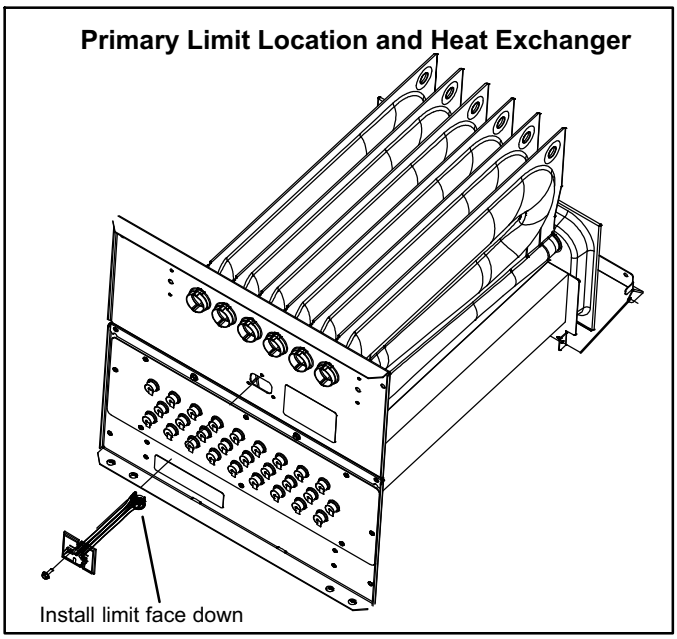


FIGURE 6

4. Gas Valve (GV1)

The EL195DF uses an internally redundant to valve to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used.

24VAC terminals and gas control switch are located on top of the valve. All terminals on the gas valve are connected to wires from the ignition control. 24V applied to the terminals opens the valve.

Inlet and outlet pressure taps are located on the valve. A manifold adjustment screw is also located on the valve. An LP/Propane changeover kit is available.

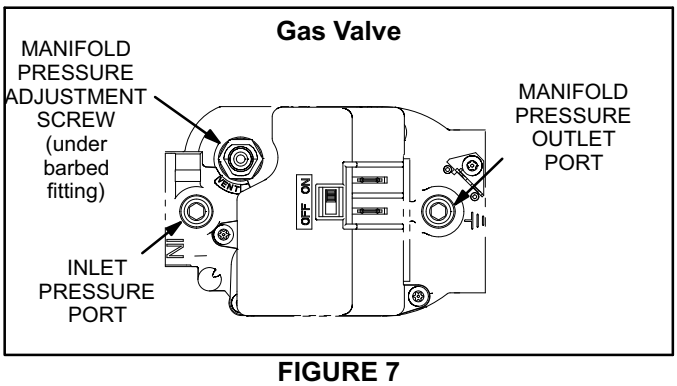


FIGURE 7

5. Flame Sensor (Figure 5)

A flame sensor is located on the left side of the burner support. The sensor is mounted on the bottom burner box plate and the tip protrudes into the flame envelope of the leftmost burner. The sensor can be removed for service without removing any part of the burners. During operation, flame is sensed by current passed through the flame and sensing electrode. The ignition control allows the gas valve to remain open as long as flame signal is sensed.

NOTE - The EL195DF is polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.

A microamp DC meter is needed to check the flame signal on the integrated control.

Flame (microamp) signal is an electrical current which passes from the integrated control to the sensor during unit operation. Current passes from the sensor through the flame to ground to complete a safety circuit.

To Measure Flame Signal - Integrated Control:

Use a digital readout meter capable of reading DC microamps. See figure 8 for flame signal check.

1 - Set the meter to the DC amps scale.
2 - Turn off supply voltage to control.
3 - Disconnect integrated control flame sensor wire from the flame sensor.
4 - Connect (-) lead to flame sensor.
5 - Connect (+) lead to the ignition control sensor wire.
6 - Turn supply voltage on and close thermostat contacts to cycle system.
7 - When main burners are in operation for two minutes, take reading.

6. Ignitor (Figure 5)

EL195DF units use a mini-nitride ignitor made from a proprietary ceramic material. To check ignitor, measure its resistance and voltage. A value of 39 to 70 ohms indicates a good ignitor. Voltage to the ignitor should be 102VAC - 132VAC. See figure 9 for resistance and voltage checks.

Measuring Flame Signal

Flame Signal In Microamps

Normal	Low	Drop Out
$\geq$ 1.5	0.5 - 1.4	$\leq$ 0.4

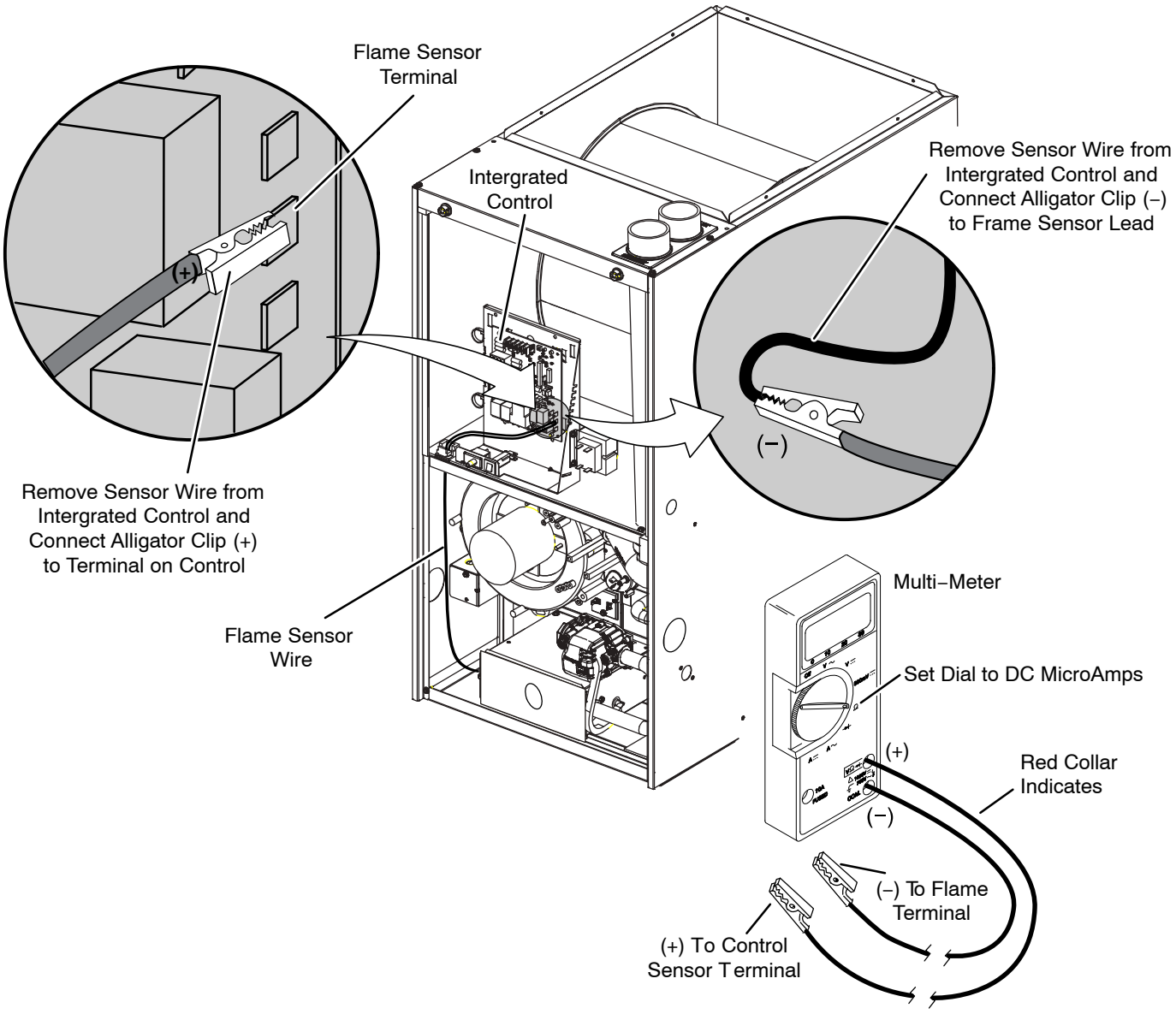

Flame Sensor Terminal
Intergrated Control
Remove Sensor Wire from Intergrated Control and Connect Alligator Clip (–) to Frame Sensor Lead
(+)
(–)
Remove Sensor Wire from Intergrated Control and Connect Alligator Clip (+) to Terminal on Control
Flame Sensor Wire
Multi–Meter
Set Dial to DC MicroAmps
(+)
(–)
Red Collar Indicates
(–) To Flame Terminal
(+) To Control Sensor Terminal

FIGURE 8

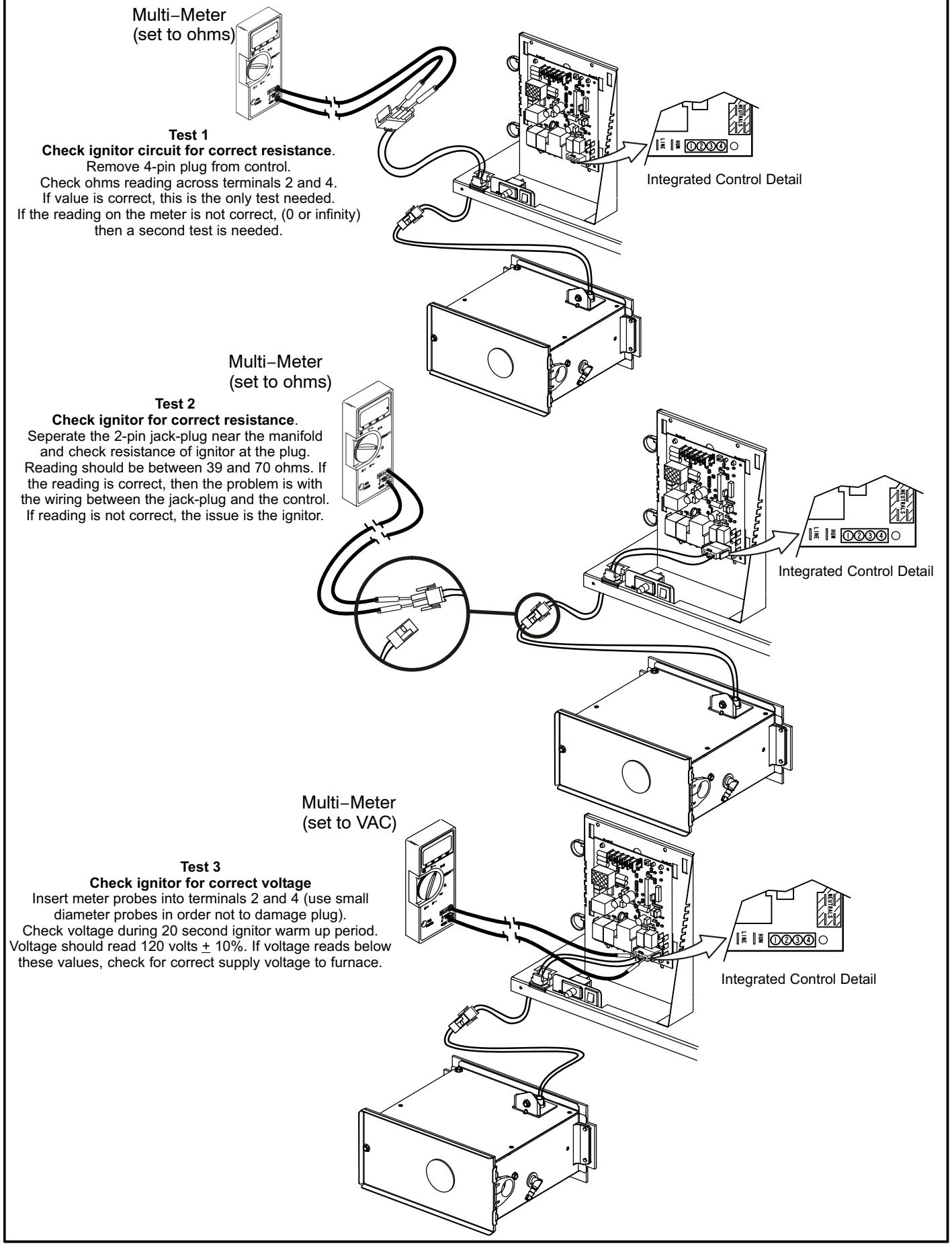

Multi−Meter
(set to ohms)
Test 1
Check ignitor circuit for correct resistance.
Remove 4-pin plug from control.
Check ohms reading across terminals 2 and 4.
If value is correct, this is the only test needed.
If the reading on the meter is not correct, (0 or infinity)
then a second test is needed.
Integrated Control Detail
Multi−Meter
(set to ohms)
Test 2
Check ignitor for correct resistance.
Seperate the 2-pin jack-plug near the manifold
and check resistance of ignitor at the plug.
Reading should be between 39 and 70 ohms. If
the reading is correct, then the problem is with
the wiring between the jack-plug and the control.
If reading is not correct, the issue is the ignitor.
Integrated Control Detail
Multi−Meter
(set to VAC)
Test 3
Check ignitor for correct voltage
Insert meter probes into terminals 2 and 4 (use small
diameter probes in order not to damage plug).
Check voltage during 20 second ignitor warm up period.
Voltage should read 120 volts ± 10%. If voltage reads below
these values, check for correct supply voltage to furnace.
Integrated Control Detail

FIGURE 9

7. Combustion Air Inducer (B6) & Cold End Header Box

All EL195DF units use a combustion air inducer to move air through the burners and heat exchanger during heating operation. The blower uses a shaded pole 120VAC motor. The motor operates during all heating operation and is controlled by burner ignition control A3. Blower operates continuously while there is a call for heat. The burner ignition control will not proceed with the ignition sequence until combustion air inducer operation is sensed by the proving switches.

The CAI is installed on the cold end header box. The cold end header box is a single piece made of hard plastic. The box has an internal channel where the combustion air inducer creates negative pressure at unit start up. The channel contains an orifice used to regulate flow created by the CAI. The box has pressure taps for the CAI pressure switch hoses. The pressure switch measure the pressure across the CAI orifice or difference in the channel and the box. **If replacement is necessary the gaskets used to seal the box to the vestibule panel and the CAI to the box, must also be replaced.**

TABLE 4

EL195DF Unit	C.A.I. Orifice Size
-045	0.618”
-070	0.810”
-090	0.973”
-110	1.040”

8. Combustion Air Pressure Switch (Figure 10)

EL195DF series units are equipped with a differential pressure switch located on the cold end header box. The switches monitor across the CAI orifice to insure proper flow through the heat exchanger.

The switch is a SPST N.O. prove switch electrically connected to the integrated control. The purpose of the switch is to prevent burner operation if the combustion air inducer is not moving enough air for proper combustion.

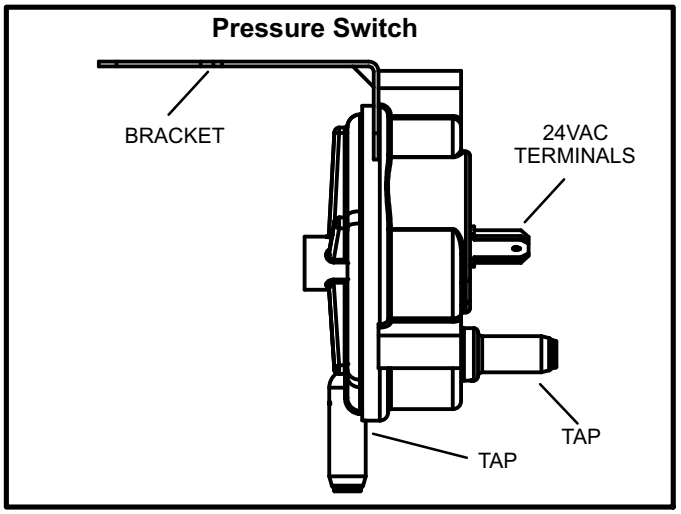


FIGURE 10

On start-up, the switch senses that the combustion air inducer is operating. It closes a circuit to the ignition control when the difference in pressure across the CAI orifice exceeds a non-adjustable factory setting. If the switch does not successfully sense the required differential, the switch cannot close and the furnace cannot operate. If the flue or air inlet become obstructed during operation, the switch senses a loss of pressure differential and opens the circuit to the ignition control. If the condensate line is blocked, water will back up into the header box and reduce the pressure differential across the switch. The prove switch opens if the differential drops below the set point. See table 5.

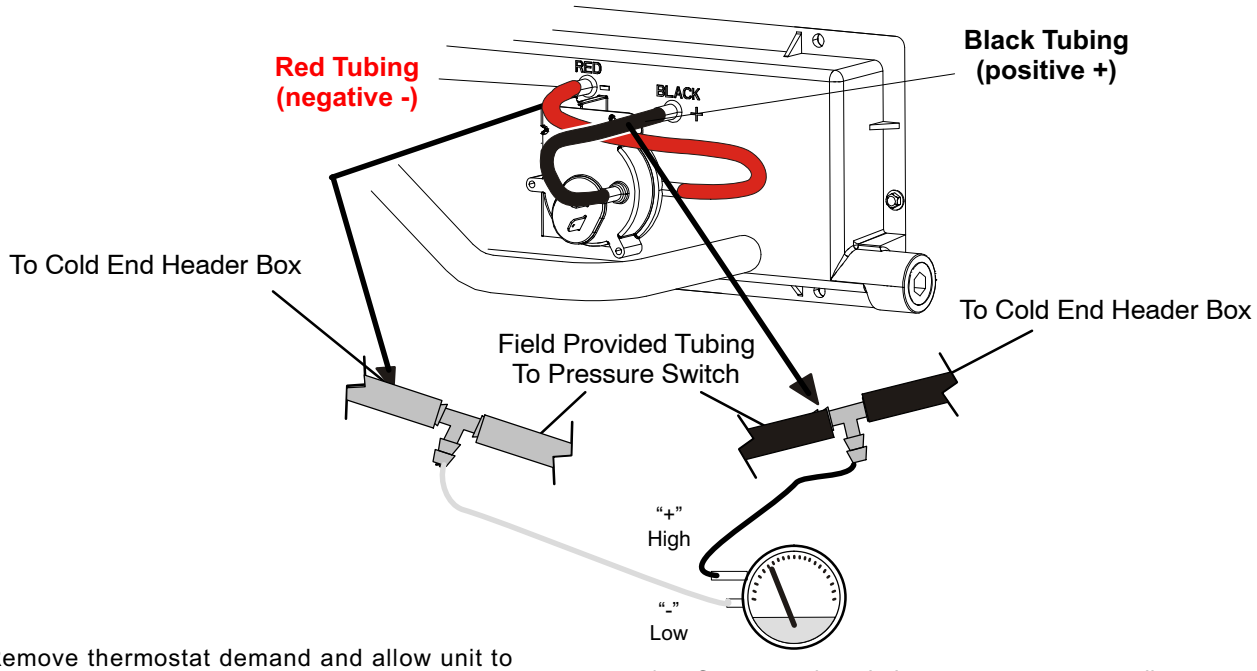
Checks of pressure differential can aid in troubleshooting. When measuring the pressure differential, readings should be taken at the pressure switch. See figure 11 and table 6. Lack of differential usually indicates problems in the intake or exhaust piping, but may indicate problems in the heat exchanger, condensing coil, header boxes, combustion inducer or other components.

TABLE 5

EL195 Unit	Altitude ft		
	0 - 4500	4501 - 7500	7501 - 10000
	Set Point	SetPoint	Set Point
-045	-0.65	-0.65	-0.60
-070	-0.90	-0.85	-0.65
-090	-0.90	-0.85	-0.65
-110	-0.90	-0.80	-0.65

**Set point is factory set and non-adjustable*

Measuring Pressure Differential



1 - Remove thermostat demand and allow unit to cycle off.

2 - Install a tee in the negative (-) line (red tubing) and a tee in the positive (+) line (black tubing) running from the pressure switch to the cold end header box.

3 - Install a manometer with hose from the negative (-) side of the manometer to the tee installed in the negative (-) line and with hose from the positive (+) side of the manometer to the tee in the positive (+) line.

NOTE - Both sides of the cold end header box are negative. However the (+) port reads less negative pressure than the (-) port.

4 - Operate unit and observe manometer reading. *Readings will change as heat exchanger warms.*
a. Take one reading immediately after start-up.
b. Take a second reading after unit has reached steady state (approximately 5 minutes). This will be the pressure differential.
The pressure differential should be greater than those listed in table 5.

5 - Remove thermostat demand and allow to cycle off.

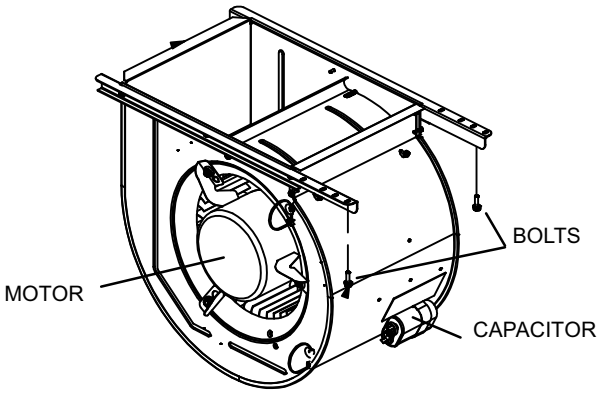
6 - Remove manometer and tee's. Reinstall combustion air sensing hoses to the pressure switch.

FIGURE 11

C-Blower Compartment

Blower motor (B3) and capacitor (C4), are located in the blower compartment. The blower compartment can be accessed by removing the blower access panel.

Blower Motor Housing



To Remove Blower From Unit: Disconnect Power, Remove Control Box, Remove Bolts and Unplug Motor Wires From Integrated Control. Then Slide Out Front of Unit.

FIGURE 12

1.Blower Motor (B3) and Capacitor (C4)

All EL195DF units use single-phase direct-drive blower motors. All motors are 120V permanent split capacitor motors to ensure maximum efficiency. See SPECIFICATIONS table at the front of this manual for more detail. See motor nameplate for capacitor ratings.

TABLE 6

Pressure Switch Troubleshooting Guide	
Problem	Corrective Action
Pressure switch stuck closed	Check that the pressure switch is open without the combustion air inducer operating. Replace if defective.
Pressure switch does not close due to obstruction in vent pipe.	Check for restricted vent. Remove all blockage. Check for proper vent sizing. See table 10.
Pressure switch does not close due to incorrect routing of the pressure switch tubing.	Check that the pressure switch tubing is correctly routed. Correctly route pressure witch line.
Pressure switch does not close due to obstructions in the pressure switch line.	Remove any obstructions from the the pressure switch line and/or taps
Pressure switch tubing damaged.	Check pressure switch tubing for leaks. Replace damaged tubing if necessary.
Condensate in pressure switch tubing.	Check pressure switch tubing for condensate. Remove condensate from tubing.
Pressure switch does not close due to a low differential pressure across the pressure switch.	Check the differential pressure across the pressure switch. Check for restricted inlet vent. Remove all blockage. Check for proper vent sizing and run length. See table 10.
Wrong pressure switch installed in the unit, or pressure switch is out of calibration	Check that the correct pressure switch is installed in the unit. Replace pressure switch if necessary.
Miswiring of furnace or improper connections at pressure switch.	Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
Pressure switch failure.	If all the above modes of failure have been checked, the pressure switch may have failed. Replace pressure switch and determine if unit will operate.
Damaged condensate trap.	Check trap for any cracks or damage and replace if necessary.
Cold end header box does not drain properly.	Check that the furnace is set properly with a slight tilt (0 - 1/2”) towards the front if necessary. See furnace installation instruction.
Air leakage around the combustion air inducer gasket.	Check gasket and replace if necessary.
Air leakage around the cold end header box gasket.	Check gasket and replace if necessary.
Damaged cold end header box tubing.	Check tubing and replace if necessary.

II-PLACEMENT AND INSTALLATION

Combustion, Dilution & Ventilation Air

If the EL195DF is installed as a Non-Direct Vent Furnace, follow the guidelines in this section.

NOTE *- In Non-Direct Vent installations, combustion air is taken from indoors and flue gases are discharged outdoors.*

In the past, there was no problem in bringing in sufficient outdoor air for combustion. Infiltration provided all the air that was needed. In today's homes, tight construction practices make it necessary to bring in air from outside for combustion. Take into account that exhaust fans, appliance vents, chimneys, and fireplaces force additional air that could be used for combustion out of the house. Unless outside air is brought into the house for combustion, negative pressure (outside pressure is greater than inside pressure) will build to the point that a downdraft can occur in the furnace vent pipe or chimney. As a result, combustion gases enter the living space creating a potentially dangerous situation.

In the absence of local codes concerning air for combustion and ventilation, use the guidelines and procedures in this section to install EL195DF furnaces to ensure efficient and safe operation. You must consider combustion air needs and requirements for exhaust vents and gas piping. A portion of this information has been reprinted with permission from the National Fuel Gas Code (ANSI-Z223.1/NFPA 54). This reprinted material is not the complete and official position of the ANSI on the referenced subject, which is represented only by the standard in its entirety.

In Canada, refer to the CSA B149 installation codes.

⚠ CAUTION

Do not install the furnace in a corrosive or contaminated atmosphere. Meet all combustion and ventilation air requirements, as well as all local codes.

All gas-fired appliances require air for the combustion process. If sufficient combustion air is not available, the furnace or other appliance will operate inefficiently and unsafely. Enough air must be provided to meet the needs of all fuel-burning appliances and appliances such as exhaust fans which force air out of the house. When fireplaces, exhaust fans, or clothes dryers are used at the same time as the furnace, much more air is required to ensure proper combustion and to prevent a downdraft. Insufficient air causes incomplete combustion which can result in carbon monoxide.

In addition to providing combustion air, fresh outdoor air dilutes contaminants in the indoor air. These contaminants may include bleaches, adhesives, detergents, solvents and other contaminants which can corrode furnace components.

The requirements for providing air for combustion and ventilation depend largely on whether the furnace is installed in an unconfined or a confined space.

Unconfined Space

An unconfined space is an area such as a basement or large equipment room with a volume greater than 50 cubic feet (1.42 m^3) per 1,000 Btu (.29 kW) per hour of the combined input rating of all appliances installed in that space. This space also includes adjacent rooms which are not separated by a door. Though an area may appear to be unconfined, it might be necessary to bring in outdoor air for combustion if the structure does not provide enough air by infiltration. If the furnace is located in a building of tight construction with weather stripping and caulking around the windows and doors, follow the procedures in the Air from Outside section.

Confined Space

A confined space is an area with a volume less than 50 cubic feet (1.42 m^3) per 1,000 Btu (.29 kW) per hour of the combined input rating of all appliances installed in that space. This definition includes furnace closets or small equipment rooms.

When the furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air ***must be*** handled by ducts which are sealed to the furnace casing and which terminate outside the space containing the furnace. This is especially important when the furnace is mounted on a platform in a confined space such as a closet or small equipment room. Even a small leak around the base of the unit at the platform or at the return air duct connection can cause a potentially dangerous negative pressure condition. Air for combustion and ventilation can be brought into the confined space either from inside the building or from outside.

Air from Inside

If the confined space that houses the furnace adjoins a space categorized as unconfined, air can be brought in by providing two permanent openings between the two spaces. Each opening must have a minimum free area of 1 square inch (645 mm^2) per 1,000 Btu (.29 kW) per hour of total input rating of all gas-fired equipment in the confined space. Each opening must be at least 100 square inches (64516 mm^2). One opening shall be within 12 inches (305 mm) of the top of the enclosure and one opening within 12 inches (305 mm) of the bottom. See figure 13.

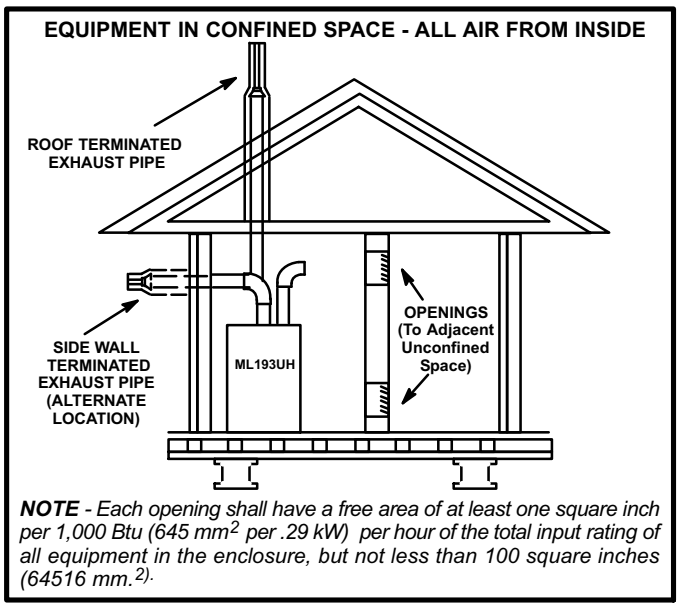

EQUIPMENT IN CONFINED SPACE - ALL AIR FROM INSIDE
ROOF TERMINATED EXHAUST PIPE
SIDE WALL TERMINATED EXHAUST PIPE (ALTERNATE LOCATION)
ML193UH
OPENINGS (To Adjacent Unconfined Space)
NOTE - Each opening shall have a free area of at least one square inch per 1,000 Btu (645 mm2 per .29 kW) per hour of the total input rating of all equipment in the enclosure, but not less than 100 square inches (64516 mm.2).

FIGURE 13

Air from Outside

If air from outside is brought in for combustion and ventilation, the confined space shall be provided with two permanent openings. One opening shall be within 12” (305mm) of the top of the enclosure and one within 12” (305mm) of the bottom. These openings must communicate directly or by ducts with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors or indirectly through vertical ducts. Each opening shall have a minimum free area of 1 square inch per 4,000 Btu (645mm^2 per 1.17kW) per hour of total input rating of all equipment in the enclosure. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 Btu (645mm^2 per .59kW) per total input rating of all equipment in the enclosure (See figure 14).

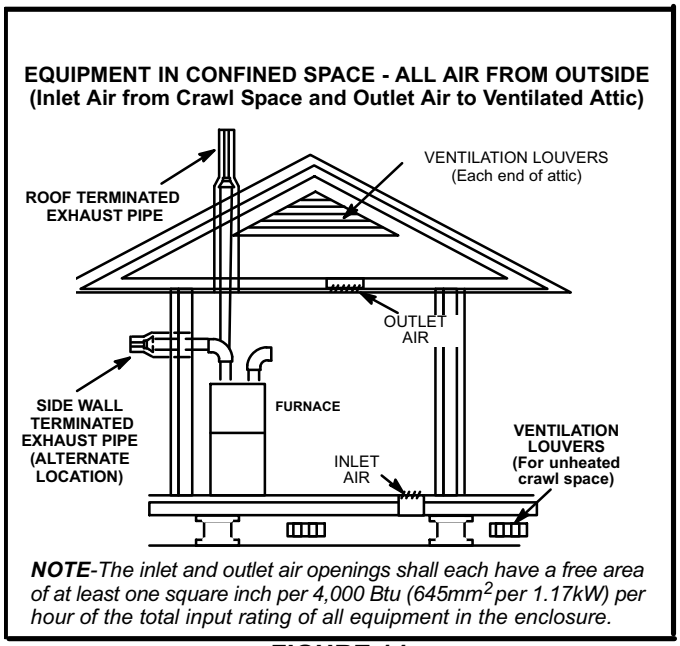

EQUIPMENT IN CONFINED SPACE - ALL AIR FROM OUTSIDE
(Inlet Air from Crawl Space and Outlet Air to Ventilated Attic)
ROOF TERMINATED EXHAUST PIPE
VENTILATION LOUVERS (Each end of attic)
OUTLET AIR
SIDE WALL TERMINATED EXHAUST PIPE (ALTERNATE LOCATION)
FURNACE
INLET AIR
VENTILATION LOUVERS (For unheated crawl space)
NOTE-The inlet and outlet air openings shall each have a free area of at least one square inch per 4,000 Btu (645mm2 per 1.17kW) per hour of the total input rating of all equipment in the enclosure.

FIGURE 14

If air from outside is brought in for combustion and ventilation, the confined space must have two permanent openings. One opening shall be within 12 inches (305 mm) of the top of the enclosure and one opening within 12 inches (305 mm) of the bottom. These openings must communicate directly or by ducts with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors or indirectly through vertical ducts. Each opening shall have a minimum free area of 1 square inch (645 mm^2) per 4,000 Btu (1.17 kW) per hour of total input rating of all equipment in the enclosure. See figures 14 and 15. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch (645 mm^2) per 2,000 Btu (.56 kW) per total input rating of all equipment in the enclosure. See figure 16. When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be no less than 3 inches (75 mm). In calculating free area, the blocking effect of louvers, grilles, or screens must be considered. If the design and free area of protective covering is not known for calculating the size opening required, it may be assumed that wood louvers will have 20 to 25 percent free area and metal louvers and grilles will have 60 to 75 percent free area. Louvers and grilles must be fixed in the open position or interlocked with the equipment so that they are opened automatically during equipment operation.

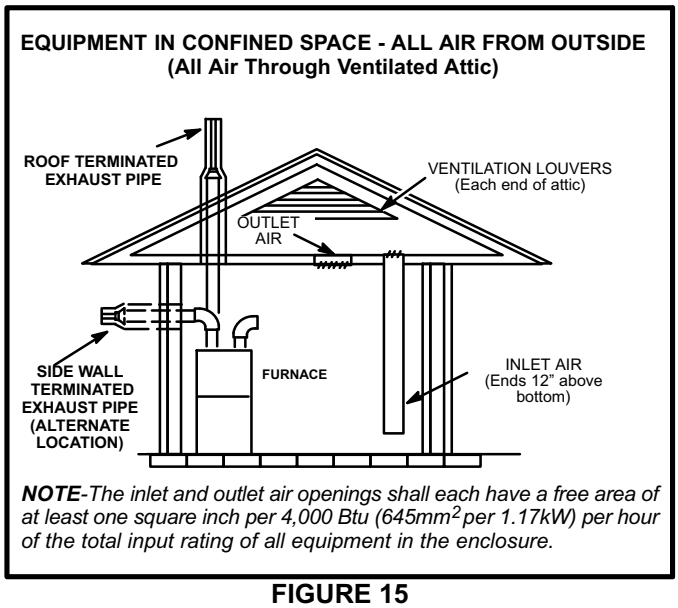
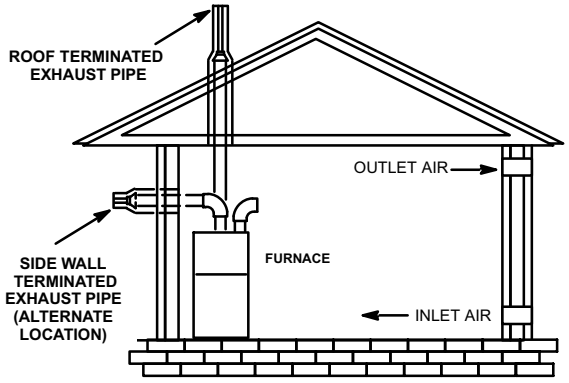

EQUIPMENT IN CONFINED SPACE - ALL AIR FROM OUTSIDE
(All Air Through Ventilated Attic)
ROOF TERMINATED EXHAUST PIPE
VENTILATION LOUVERS (Each end of attic)
OUTLET AIR
SIDE WALL TERMINATED EXHAUST PIPE (ALTERNATE LOCATION)
FURNACE
INLET AIR (Ends 12” above bottom)
NOTE-The inlet and outlet air openings shall each have a free area of at least one square inch per 4,000 Btu (645mm2 per 1.17kW) per hour of the total input rating of all equipment in the enclosure.

FIGURE 15



***NOTE**-Each air duct opening shall have a free area of at least one square inch per 2,000 Btu (645mm^2 per .59kW) per hour of the total input rating of all equipment in the enclosure. If the equipment room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of at least 1 square inch per 4,000 Btu (645mm^2 per 1.17kW) per hour of the total input rating of all other equipment in the enclosure.*

FIGURE 16

Pipe & Fittings Specifications

All pipe, fittings, primer and solvent cement must conform with American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM) standards. The solvent shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall show no gelation, stratification, or separation that cannot be removed by stirring. Refer to the table 7 below for approved piping and fitting materials.

⚠ CAUTION

Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Do not use excessive amounts of solvent cement when making joints. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes.

TABLE 7
PIPING AND FITTINGS SPECIFICATIONS

Schedule 40 PVC (Pipe)	D1785
Schedule 40 PVC (Cellular Core Pipe)	F891
Schedule 40 PVC (Fittings)	D2466
Schedule 40 CPVC (Pipe)	F441
Schedule 40 CPVC (Fittings)	F438
SDR-21 PVC or SDR-26 PVC (Pipe)	D2241
SDR-21 CPVC or SDR-26 CPVC (Pipe)	F442
Schedule 40 ABS Cellular Core DWV (Pipe)	F628
Schedule 40 ABS (Pipe)	D1527
Schedule 40 ABS (Fittings)	D2468
ABS-DWV (Drain Waste & Vent) (Pipe & Fittings)	D2661
PVC-DWV (Drain Waste & Vent) Pipe & Fittings)	D2665
PRIMER & SOLVENT CEMENT	**ASTM SPECIFICATION**
PVC & CPVC Primer	F656
PVC Solvent Cement	D2564
CPVC Solvent Cement	F493
ABS Solvent Cement	D2235
PVC/CPVC/ABS All Purpose Cement For Fittings & Pipe of the same material	D2564, D2235, F493
ABS to PVC or CPVC Transition Solvent Cement	D3138
CANADA PIPE & FITTING & SOLVENT CEMENT	**MARKING**
PVC & CPVC Pipe and Fittings	ULCS636
PVC & CPVC Solvent Cement	
ABS to PVC or CPVC Transition Cement	

⚠ IMPORTANT

EL195DF exhaust and intake connections are made of PVC. Use PVC primer and solvent cement when using PVC vent pipe. When using ABS vent pipe, use transitional solvent cement to make connections to the PVC fittings in the unit.

Use PVC primer and solvent cement or ABS solvent cement meeting ASTM specifications, refer to Table 7. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Use transition solvent cement when bonding ABS to either PVC or CPVC.

Low temperature solvent cement is recommended during cooler weather. Metal or plastic strapping may be used for vent pipe hangers. Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

***Canadian Applications Only** - Pipe, fittings, primer and solvent cement used to vent (exhaust) this appliance must be certified to ULC S636 and supplied by a single manufacturer as part of an approved vent (exhaust) system. In addition, the first three feet of vent pipe from the furnace flue collar must be accessible for inspection.*

TABLE 8
OUTDOOR TERMINATION USAGE

Input Size	Vent Pipe Dia. in.	STANDARD KITS					CONCENTRIC KITS		
		Flush-Mount Kit	Wall Kit		Wall Ring Kit	Field Fabricated	1-1/2 inch	2 inch	3 inch
			2 inch	3 inch	2 inch				
		51W11	22G44 (US) [4]30G28 (CA)	44J40 (US) [4]81J20 (CA)	15F74		71M80 (US) [4]44W92 (CA)	69M29 (US) [4]44W92 (CA)	60L46 (US) [4]44W93 (CA)
045	2	[3]YES	YES	[1]YES	[1]YES	[5]YES	[2]YES		
	2-1/2	[3]YES	YES	[1]YES	[1]YES	[5]YES	[2]YES		
	3	[3]YES	YES	[1]YES	[1]YES	[5]YES	[2]YES		
070	2	[3]YES	YES	[1]YES	[1]YES	[5]YES	[2]YES		
	2-1/2	[3]YES	YES	[1]YES	[1]YES	[5]YES	[2]YES		
	3	[3]YES	YES	[1]YES	[1]YES	[5]YES	[2]YES		
090	2	[3]YES		YES	YES	[5]YES		YES	YES
	2-1/2	[3]YES		YES	YES	[5]YES		YES	YES
	3	[3]YES		YES	YES	[5]YES		YES	YES
110	2	YES		YES	YES	[5]YES		YES	YES
	2-1/2	YES		YES		[5]YES		YES	YES
	3	YES		YES		[5]YES		YES	YES
135	3	YES		YES		[5]YES			YES

NOTE - Standard Terminations do not include any vent pipe or elbows external to the structure. Any vent pipe or elbows external to the structure must be included in total vent length calculations. See vent length tables.

[1]Requires field-provided outdoor 1-1/2" exhaust accelerator.

[2]Concentric kits 71M80 and 44W92 include 1-1/2" outdoor accelerator, when used with 045 and 070 input models.

[3] Flush mount kit 51W11 includes 1-1/2 in. outdoor exhaust accelerator, required when used with 045, 070 and 090 input models.

[4] Termination kits 30G28, 44W92, 4493 and 81J20 are certified to ULC S636 for use in Canada only.

[5] See table 11 for vent accelerator requirements.

Joint Cementing Procedure

All cementing of joints should be done according to the specifications outlined in ASTM D 2855.

***NOTE** - A sheet metal screw may be used to secure the intake pipe to the connector, if desired. Use a drill or self tapping screw to make a pilot hole.*

⚠ DANGER

DANGER OF EXPLOSION!

Fumes from PVC glue may ignite during system check. Allow fumes to dissipate for at least 5 minutes before placing unit into operation.

1 - Measure and cut vent pipe to desired length.

2 - Debur and chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, edge of pipe may remove cement from fitting socket and result in a leaking joint.

***NOTE -** Check the inside of vent pipe thoroughly for any obstruction that may alter furnace operation.*

3 - Clean and dry surfaces to be joined.

4 - Test fit joint and mark depth of fitting on outside of pipe.

5 - Uniformly apply a liberal coat of PVC primer for PVC or use a clean dry cloth for ABS to clean inside socket surface of fitting and male end of pipe to depth of fitting socket.

6 - Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement should be applied lightly but uniformly to inside of socket. Take care to keep excess cement out of socket. Apply second coat to end of pipe.

***NOTE** - Time is critical at this stage. Do not allow primer to dry before applying cement.*

7 - Immediately after applying last coat of cement to pipe, and while both inside socket surface and end of pipe are wet with cement, forcefully insert end of pipe into socket until it bottoms out. Turn PVC pipe 1/4 turn during assembly (but not after pipe is fully inserted) to distribute cement evenly. DO NOT turn ABS or cellular core pipe.

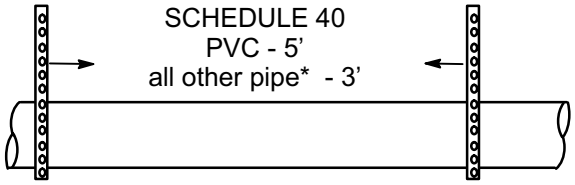
***NOTE** - Assembly should be completed within 20 seconds after last application of cement. Hammer blows should not be used when inserting pipe.*

8 - After assembly, wipe excess cement from pipe at end of fitting socket. A properly made joint will show a bead around its entire perimeter. Any gaps may indicate an improper assembly due to insufficient solvent.

9 - Handle joints carefully until completely set.

Venting Practices

Piping Suspension Guidelines



** See table 7 for allowable pipe.*

***NOTE** - Isolate piping at the point where it exits the outside wall or roof in order to prevent transmission of vibration to the structure.*

Wall Thickness Guidelines

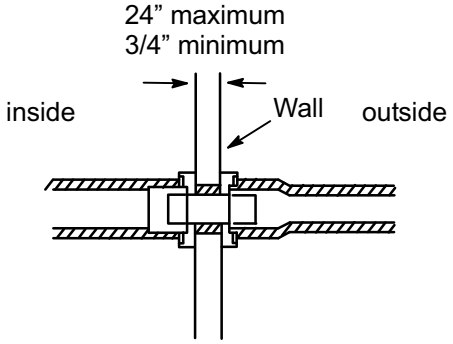
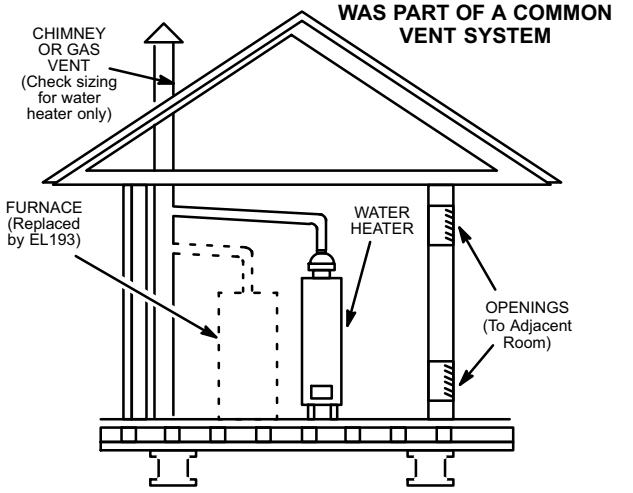


FIGURE 17


REPLACING FURNACE THAT WAS PART OF A COMMON VENT SYSTEM
CHIMNEY OR GAS VENT (Check sizing for water heater only)
FURNACE (Replaced by EL193)
WATER HEATER
OPENINGS (To Adjacent Room)

If an EL195DF furnace replaces a furnace which was commonly vented with another gas appliance, the size of the existing vent pipe for that gas appliance must be checked. Without the heat of the original furnace flue products, the existing vent pipe is probably oversized for the single water heater or other appliance. The vent should be checked for proper draw with the remaining appliance.

FIGURE 18

2. In areas where piping penetrates joists or interior walls, hole must be large enough to allow clearance on all sides of pipe through center of hole using a hanger.

3. When furnace is installed in a residence where unit is shut down for an extended period of time, such as a vacation home, make provisions for draining condensate collection trap and lines.

Exhaust Piping (Figures 20 and 21)

Route piping to outside of structure. Continue with installation following instructions given in piping termination section.

⚠ CAUTION

Do not discharge exhaust into an existing stack or stack that also serves another gas appliance. If vertical discharge through an existing unused stack is required, insert PVC pipe inside the stack until the end is even with the top or outlet end of the metal stack.

⚠ CAUTION

The exhaust vent pipe operates under positive pressure and must be completely sealed to prevent leakage of combustion products into the living space.

Vent Piping Guidelines

The EL195DF can be installed as either a Non-Direct Vent or a Direct Vent gas central furnace.

***NOTE** - In Non-Direct Vent installations, combustion air is taken from indoors and flue gases are discharged outdoors. In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged outdoors.*

Intake and exhaust pipe sizing -- Size pipe according to tables 9 and 10. Count all elbows inside and outside the home. Table 9 lists the *minimum* vent pipe lengths permitted. Table 10 lists the *maximum* pipe lengths permitted.

TABLE 9
MINIMUM VENT PIPE LENGTHS

EL195DF MODEL	MIN. VENT LENGTH*
045, 070, 090, 110	15 ft. or 5 ft plus 2 elbows or 10 ft plus 1 elbow

**Any approved termination may be added to the minimum length listed.*

Regardless of the diameter of pipe used, the standard roof and wall terminations described in section *Exhaust Piping Terminations* should be used. Exhaust vent termination pipe is sized to optimize the velocity of the exhaust gas as it exits the termination. Refer to table 11.

In some applications which permit the use of several different sizes of vent pipe, a combination vent pipe may be used. Contact Lennox' Application Department for assistance in sizing vent pipe in these applications.

⚠ IMPORTANT

Do not use screens or perforated metal in exhaust or intake terminations. Doing so will cause freeze-ups and may block the terminations.

Use the following steps to correctly size vent pipe diameter.

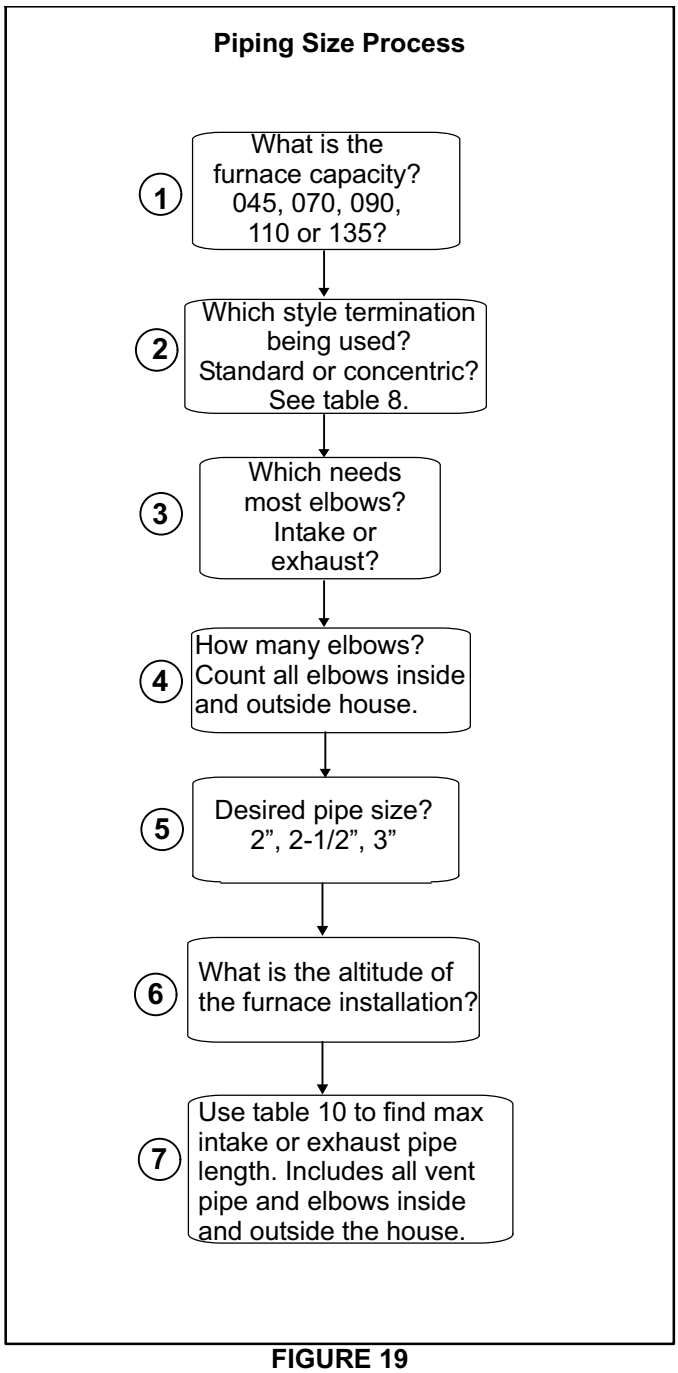

Piping Size Process
1
What is the furnace capacity? 045, 070, 090, 110 or 135?
2
Which style termination being used? Standard or concentric? See table 8.
3
Which needs most elbows? Intake or exhaust?
4
How many elbows? Count all elbows inside and outside house.
5
Desired pipe size? 2", 2-1/2", 3"
6
What is the altitude of the furnace installation?
7
Use table 10 to find max intake or exhaust pipe length. Includes all vent pipe and elbows inside and outside the house.

FIGURE 19

***NOTE** - It is acceptable to use any pipe size which fits within the guidelines allowed in table 10.*

***NOTE** - All horizontal runs of exhaust pipe must slope back toward unit. A minimum of 1/4" (6mm) drop for each 12" (305mm) of horizontal run is mandatory for drainage.*

***NOTE** - Exhaust pipe MUST be glued to furnace exhaust fittings.*

***NOTE** - Exhaust piping should be checked carefully to make sure there are no sags or low spots.*

TABLE 10
Maximum Allowable Intake or Exhaust Vent Length

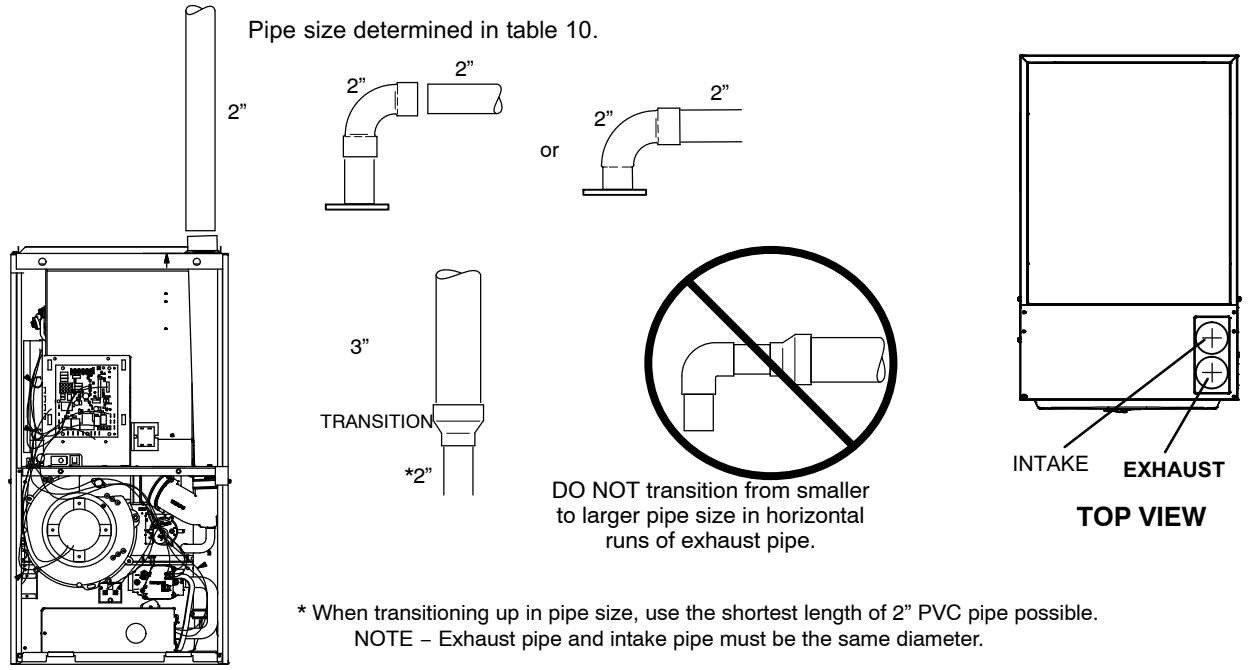
NOTE - Size intake and exhaust pipe length separately. Values in table are for Intake OR Exhaust, not combined total. Both Intake and Exhaust must be same pipe size.

NOTE - Additional vent pipe and elbows used to terminate the vent pipe outside the structure must be included in the total vent length calculation.

Standard Termination at Elevation 0 - 4500 ft												
Number Of 90° Elbows Used	2" Pipe				2-1/2" Pipe				3" Pipe			
	Model				Model				Model			
	045	070	090	110	045	070	090	110	045	070	090	110
1	81	66	44	24	115	115	93	58	138	137	118	118
2	76	61	39	19	110	110	88	53	133	132	113	113
3	71	56	34	14	105	105	83	48	128	127	108	108
4	66	51	29	n/a	100	100	78	43	123	122	103	103
5	61	46	24	n/a	95	95	73	38	118	117	98	98
6	56	41	19	n/a	90	90	68	33	113	112	93	93
7	51	36	14	n/a	85	85	63	28	108	107	88	88
8	46	31	n/a	n/a	80	80	58	23	103	102	83	83
9	41	26	n/a	n/a	75	75	53	18	98	97	78	78
10	36	21	n/a	n/a	70	70	48	13	93	92	73	73
Standard Termination Elevation 4500 - 10,000 ft												
Number Of 90° Elbows Used	2" Pipe				2-1/2" Pipe				3" Pipe			
	Model				Model				Model			
	045	070	090	110	045	070	090	110	045	070	090	110
1	81	66	44	n/a	115	115	93	58	138	137	118	118
2	76	61	39	n/a	110	110	88	53	133	132	113	113
3	71	56	34	n/a	105	105	83	48	128	127	108	108
4	66	51	29	n/a	100	100	78	43	123	122	103	103
5	61	46	24	n/a	95	95	73	38	118	117	98	98
6	56	41	19	n/a	90	90	68	33	113	112	93	93
7	51	36	14	n/a	85	85	63	28	108	107	88	88
8	46	31	n/a	n/a	80	80	58	23	103	102	83	83
9	41	26	n/a	n/a	75	75	53	18	98	97	78	78
10	36	21	n/a	n/a	70	70	48	13	93	92	73	73

Concentric Termination at Elevation 0 - 4500 ft												
Number Of 90° Elbows Used	2" Pipe				2-1/2" Pipe				3" Pipe			
	Model				Model				Model			
	045	070	090	110	045	070	090	110	045	070	090	110
1	73	58	42	22	105	105	89	54	121	121	114	114
2	68	53	37	17	100	100	84	49	116	116	109	109
3	63	48	32	12	95	95	79	44	111	111	104	104
4	58	43	27		90	90	74	39	106	106	99	99
5	53	38	22		85	85	69	34	101	101	94	94
6	48	33	17		80	80	64	29	96	96	89	89
7	43	28	12	n/a	75	75	59	24	91	91	84	84
8	38	23			70	70	54	19	86	86	79	79
9	33	18	n/a		65	65	49	14	81	81	74	74
10	28	13			60	60	44	n/a	76	76	69	69
Concentric Termination Elevation 4501 - 10,000 ft												
Number Of 90° Elbows Used	2" Pipe				2-1/2" Pipe				3" Pipe			
	Model				Model				Model			
	045	070	090	110	045	070	090	110	045	070	090	110
1	73	58	42		105	105	89	54	121	121	114	114
2	68	53	37		100	100	84	49	116	116	109	109
3	63	48	32		95	95	79	44	111	111	104	104
4	58	43	27		90	90	74	39	106	106	99	99
5	53	38	22	n/a	85	85	69	34	101	101	94	94
6	48	33	17		80	80	64	29	96	96	89	89
7	43	28	12		75	75	59	24	91	91	84	84
8	38	23			70	70	54	19	86	86	79	79
9	33	18	n/a		65	65	49	14	81	81	74	74
10	28	13			60	60	44	n/a	76	76	69	69

TYPICAL *EXHAUST* PIPE CONNECTIONS

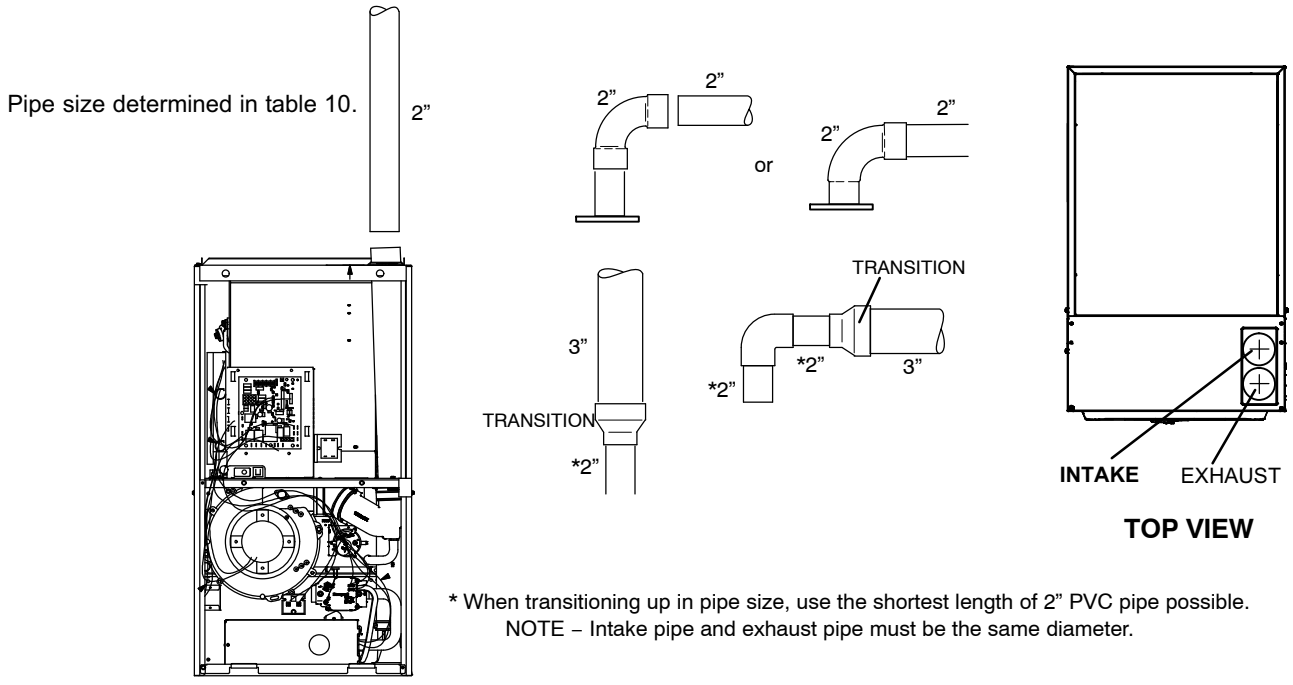


DO NOT transition from smaller to larger pipe size in horizontal runs of exhaust pipe.

* When transitioning up in pipe size, use the shortest length of 2” PVC pipe possible.
NOTE – Exhaust pipe and intake pipe must be the same diameter.

FIGURE 20

TYPICAL *INTAKE* PIPE CONNECTIONS



* When transitioning up in pipe size, use the shortest length of 2” PVC pipe possible.
NOTE – Intake pipe and exhaust pipe must be the same diameter.

FIGURE 21

Intake Piping

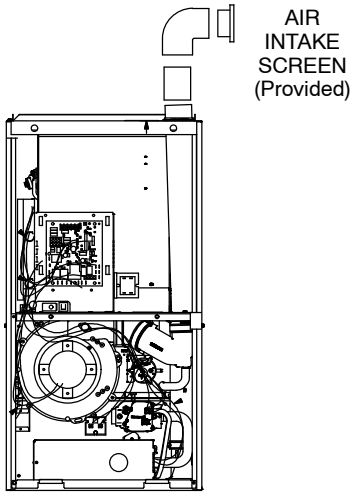
The EL195DF furnace may be installed in either **direct vent** or **non-direct vent** applications. In non-direct vent applications, when intake air will be drawn into the furnace from the surrounding space, the indoor air quality must be considered. Guidelines listed in Combustion, Dilution and Ventilation Air section must be followed.

Follow the next two steps when installing the unit in **Direct Vent applications,** where combustion air is taken from outdoors and flue gases are discharged outdoors. **The provided air intake screen must not be used in direct vent applications (outdoors).**

1 - Use cement to secure the intake pipe to the inlet air connector.

2 - Route piping to outside of structure. Continue with installation following instructions given in general guide lines for piping terminations and intake and exhaust piping terminations for direct vent sections. Refer to table 10 for pipe sizes.

TYPICAL AIR INTAKE PIPE CONNECTIONS
NON–DIRECT VENT APPLICATIONS



NOTE *- Air intake screen and elbow may be rotated, so that screen may be positioned to face forward or to either side.*

FIGURE 22

Follow the next two steps when installing the unit in **Non-Direct Vent applications** where combustion air is taken from indoors and flue gases are discharged outdoors**.**

1 **-** Use field-provided materials and the factory-provided air intake screen to route the intake piping as shown in figure 22. Maintain a minimum clearance of 3" (76mm) around the air intake opening. The air intake opening (with the protective screen) should always be directed forward, or sideways.

2 - Use cement to secure the intake pipe to the connector, if desired.

General Guidelines for Vent Terminations

In Non-Direct Vent applications, combustion air is taken from indoors and the flue gases are discharged to the outdoors. The EL195DF is then classified as a non-direct vent, Category IV gas furnace.

In Direct Vent applications, combustion air is taken from outdoors and the flue gases are discharged to the outdoors. The EL195DF is then classified as a direct vent, Category IV gas furnace.

In both Non-Direct Vent and Direct Vent applications, the vent termination is limited by local building codes. In the absence of local codes, refer to the current National Fuel Gas Code ANSI Z223-1/NFPA 54 in U.S.A., and current CSA-B149 Natural Gas and Propane Installation Codes in Canada for details.

Position termination according to location given in figure 23 or 24. In addition, position termination so it is free from any obstructions and 12" above the average snow accumulation.

At vent termination, care must be taken to maintain protective coatings over building materials (prolonged exposure to exhaust condensate can destroy protective coatings). It is recommended that the exhaust outlet not be located within 6 feet (1.8m) of a condensing unit because the condensate can damage the painted coating.

NOTE *- If winter design temperature is below 32°F (0°C), exhaust piping should be insulated with 1/2" (13mm), Armaflex or equivalent when run through unheated space. Do not leave any surface area of exhaust pipe open to outside air; exterior exhaust pipe should be insulated with 1/2" (13mm) Armaflex or equivalent. In extreme cold climate areas, 3/4" (19mm) Armaflex or equivalent may be necessary. Insulation on outside runs of exhaust pipe must be painted or wrapped to protect insulation from deterioration. Exhaust pipe insulation may not be necessary in some specific applications.*

NOTE *- During extremely cold temperatures, below approximately 20°F (6.7°C), units with long runs of vent pipe through unconditioned space, even when insulated, may form ice in the exhaust termination that prevents the unit from operating properly. Longer run times of at least 5 minutes will alleviate most icing problems. Also, a heating cable may be installed on exhaust piping and termination to prevent freeze-ups. Heating cable installation kit is available from Lennox. See Condensate Piping section for part numbers.*

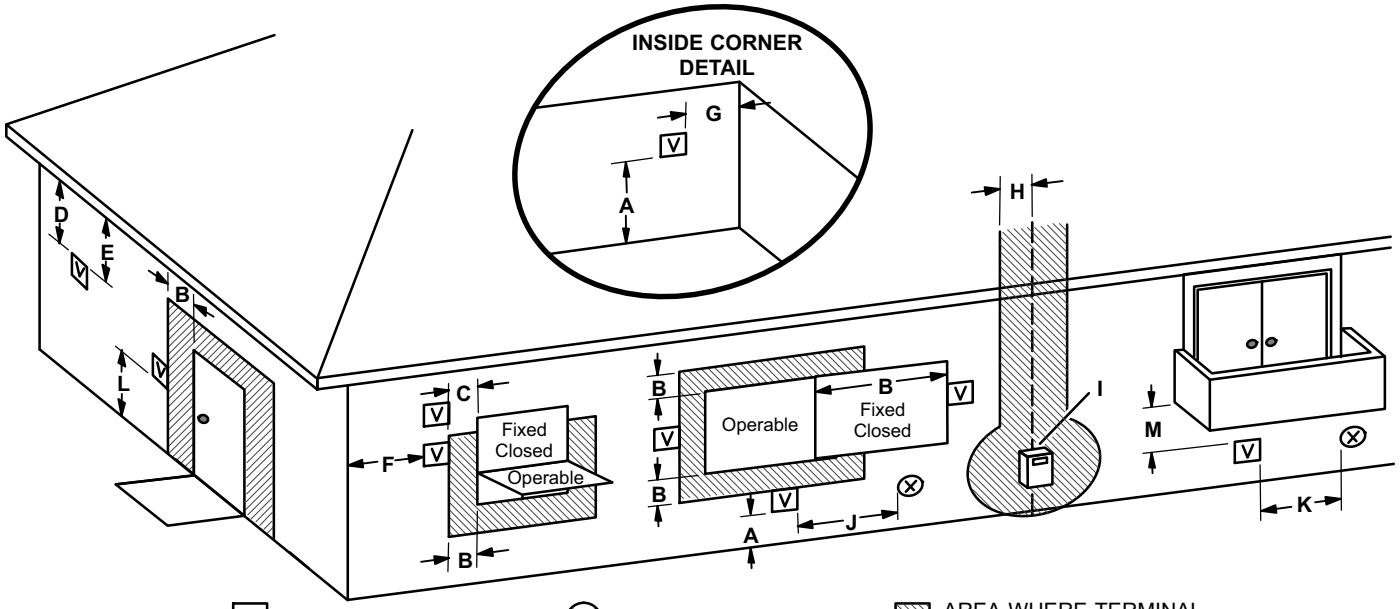
⚠ IMPORTANT

Do not use screens or perforated metal in exhaust terminations. Doing so will cause freeze-ups and may block the terminations.

⚠ IMPORTANT

For Canadian Installations Only:
In accordance to CSA International B149 installation codes, the minimum allowed distance between the combustion air intake inlet and the exhaust outlet of other appliances shall not be less than 12 inches (305mm).

VENT TERMINATION CLEARANCES
FOR NON-DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



		US Installations[1]	Canadian Installations[2]
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	4 feet (1.2 m) below or to side of opening; 1 foot (30cm) above opening	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
C =	Clearance to permanently closed window	* 12”	* 12”
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610 mm) from the center line of the terminal	* Equal to or greater than soffit depth.	* Equal to or greater than soffit depth.
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth.	* Equal to or greater than soffit depth.
F =	Clearance to outside corner	* No minimum to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	* 3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)	3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	4 feet (1.2 m) below or to side of opening; 1 foot (30 cm) above opening	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L =	Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.1m)†	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	12 inches (305mm)‡

[1] In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code
[2] In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

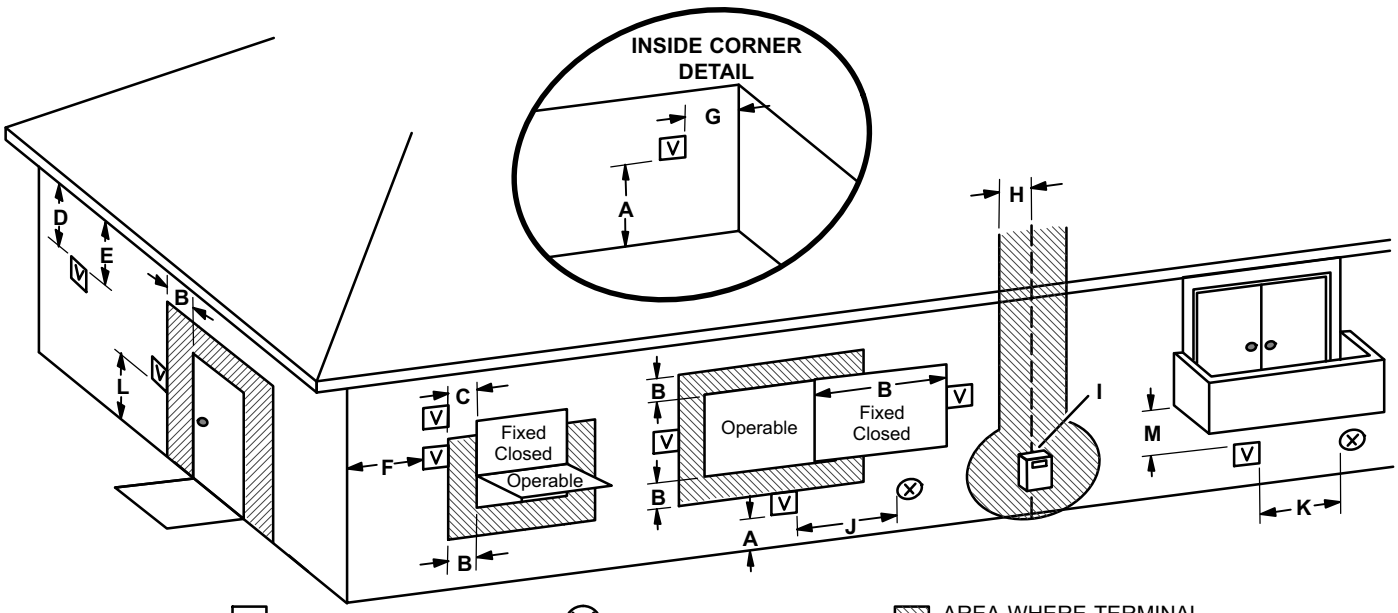
† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor. Lennox recommends avoiding this location if possible.

*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions.”

FIGURE 23

VENT TERMINATION CLEARANCES
FOR DIRECT VENT INSTALLATIONS IN THE USA AND CANADA



V VENT TERMINAL ⊗ AIR SUPPLY INLET AREA WHERE TERMINAL IS NOT PERMITTED

		US Installations[1]	Canadian Installations[2]
A =	Clearance above grade, veranda, porch, deck or balcony	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.	12 inches (305mm) or 12 in. (305mm) above average snow accumulation.
B =	Clearance to window or door that may be opened	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15 kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
C =	Clearance to permanently closed window	* 12”	* 12”
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610mm) from the center line of the terminal	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
E =	Clearance to unventilated soffit	* Equal to or greater than soffit depth	* Equal to or greater than soffit depth
F =	Clearance to outside corner	* No minimum to outside corner	* No minimum to outside corner
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly	3 feet (.9m) within a height 15 feet (4.5m) above the meter / regulator assembly
I =	Clearance to service regulator vent outlet	* 3 feet (.9m)	3 feet (.9m)
J =	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (152mm) for appliances <10,000 Btuh (3kw), 9 inches (228mm) for appliances > 10,000 Btuh (3kw) and <50,000 Btuh (15 kw), 12 inches (305mm) for appliances > 50,000 Btuh (15kw)	6 inches (152mm) for appliances <10,000 Btuh (3kw), 12 inches (305mm) for appliances > 10,000 Btuh (3kw) and <100,000 Btuh (30kw), 36 inches (.9m) for appliances > 100,000 Btuh (30kw)
K =	Clearance to mechanical air supply inlet	3 feet (.9m) above if within 10 feet (3m) horizontally	6 feet (1.8m)
L =	Clearance above paved sidewalk or paved driveway located on public property	* 7 feet (2.1m)	7 feet (2.1m)†
M =	Clearance under veranda, porch, deck or balcony	*12 inches (305mm)‡	12 inches (305mm)‡

[1] In accordance with the current ANSI Z223.1/NFPA 54 Natural Fuel Gas Code

[2] In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck or balcony is fully open on a minimum of two sides beneath the floor. Lennox recommends avoiding this location if possible.

*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and the requirements of the gas supplier and these installation instructions.”

FIGURE 24

Details of Intake and Exhaust Piping Terminations for Direct Vent Installations

***NOTE** - In Direct Vent installations, combustion air is taken from outdoors and flue gases are discharged to outdoors.*

***NOTE** - Flue gas may be slightly acidic and may adversely affect some building materials. If any vent termination is used and the flue gasses may impinge on the building material, a corrosion-resistant shield (minimum 24 inches square) should be used to protect the wall surface. If the optional tee is used, the protective shield is recommended. The shield should be constructed using wood, plastic, sheet metal or other suitable material. All seams, joints, cracks, etc. in the affected area should be sealed using an appropriate sealant. See figure 27.*

Intake and exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. Figures 25 through 37 show typical terminations.

1. Exhaust and intake exits must be in same pressure zone. Do not exit one through the roof and one on the side. Also, do not exit the intake on one side and the exhaust on another side of the house or structure.
2. Intake and exhaust pipes should be placed as close together as possible at termination end (refer to illustrations). Maximum separation is 3" (76mm) on roof terminations and 6" (152mm) on side wall terminations.
3. On roof terminations, the intake piping should terminate straight down using two 90° elbows (See figure 25).
4. Exhaust piping must terminate straight out or up as shown. A reducer may be required on the exhaust piping at the point where it exits the structure to improve the velocity of exhaust away from the intake piping. See table 11.

TABLE 11
EXHAUST PIPE TERMINATION SIZE REDUCTION

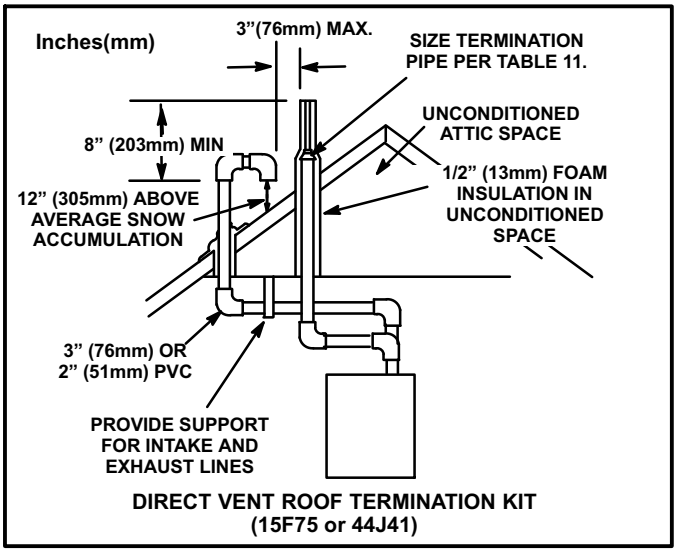
EL195 MODEL	Exhaust Pipe Size	Termination Pipe Size
*045 and *070	2" (51mm), 2-1/2" (64mm), 3" (76mm)	1-1/2" (38mm)
*090		2" (51mm)
110		2" (51mm)

**EL195DF-045, -070 and -090 units with the flush-mount termination must use the 1-1/2"accelerator supplied with the kit.*

5. On field-supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305mm) for 2" PVC and 20 inches (508mm) for 3" (76mm) PVC beyond the outside wall. Intake piping should be as short as possible. See figures 28 and 29.

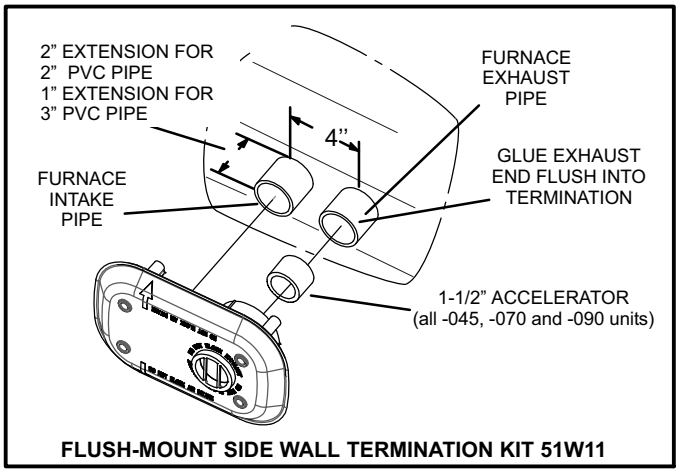
   ***NOTE** - Care must be taken to avoid recirculation of exhaust back into intake pipe.*

6. On field supplied terminations, a minimum distance between the end of the exhaust pipe and the end of the intake pipe without a termination elbow is 8" and a minimum distance of 6" with a termination elbow. See figures 28 and 29.


Inches(mm)
3"(76mm) MAX.
SIZE TERMINATION PIPE PER TABLE 11.
UNCONDITIONED ATTIC SPACE
8" (203mm) MIN
1/2" (13mm) FOAM INSULATION IN UNCONDITIONED SPACE
12" (305mm) ABOVE AVERAGE SNOW ACCUMULATION
3" (76mm) OR 2" (51mm) PVC
PROVIDE SUPPORT FOR INTAKE AND EXHAUST LINES

DIRECT VENT ROOF TERMINATION KIT (15F75 or 44J41)

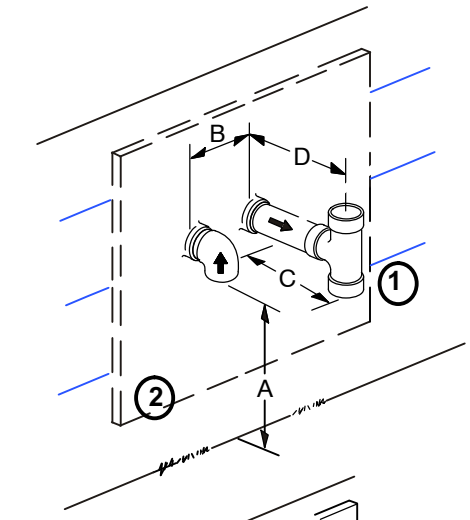
FIGURE 25

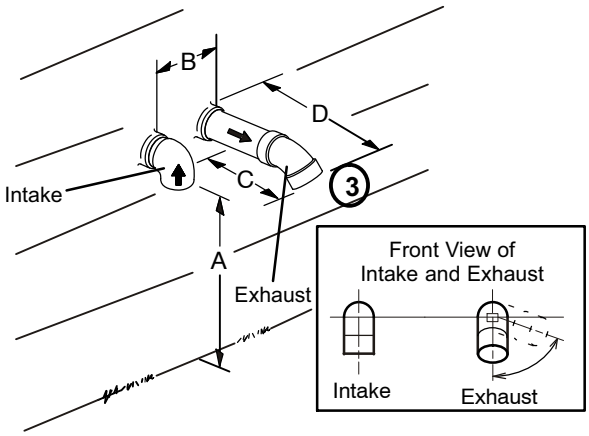

2" EXTENSION FOR 2" PVC PIPE
1" EXTENSION FOR 3" PVC PIPE
FURNACE EXHAUST PIPE
4"
GLUE EXHAUST END FLUSH INTO TERMINATION
FURNACE INTAKE PIPE
1-1/2" ACCELERATOR (all -045, -070 and -090 units)

FLUSH-MOUNT SIDE WALL TERMINATION KIT 51W11

FIGURE 26

7. If intake and exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported every 24" (610mm) as shown in figures 28 and 29. In addition, close coupled wall termination kits must be extended for use in this application. See figures 35 and 36. When exhaust and intake piping must be run up an outside wall, the exhaust piping must be terminated with pipe sized per table 11.The intake piping may be equipped with a 90° elbow turndown. Using turndown will add 5 feet (1.5m) to the equivalent length of the pipe.
8. A multiple furnace installation may use a group of up to four terminations assembled together horizontally, as shown in figure 32.





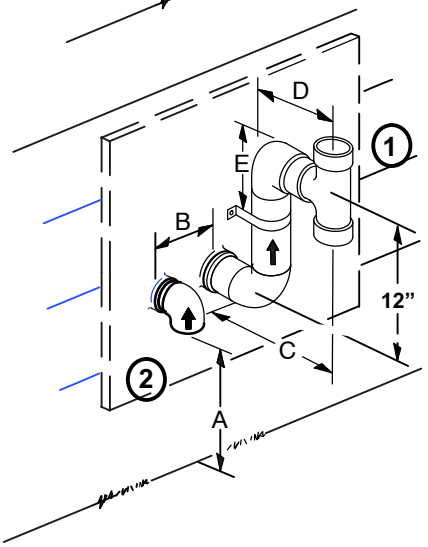


TABLE 12

	2” (51mm) Vent Pipe	3” (76mm) Vent Pipe
A- Clearance above grade or average snow accumulation	12” (305MM) Min.	12” (305MM) Min.
B-Horizontal separation between intake and exhaust	6” (152MM) Min. 24” (610 MM) Max	6” (152MM) Min. 24” (610 MM) Max
C-Minimum from end of exhaust to inlet of intake	9” (227MM) Min.	9” (227MM) Min.
D-Exhaust pipe length	12” (305MM) Min. 16” (405 MM) Max.	12” (305MM) Min. 20” (508MM) Max.
E-Wall support distance from top of each pipe (intake/exhaust)	6” (152MM) Max.	6” (152MM) Max.

NOTE - See unit installation instructions for proper exhaust pipe termination size reduction.

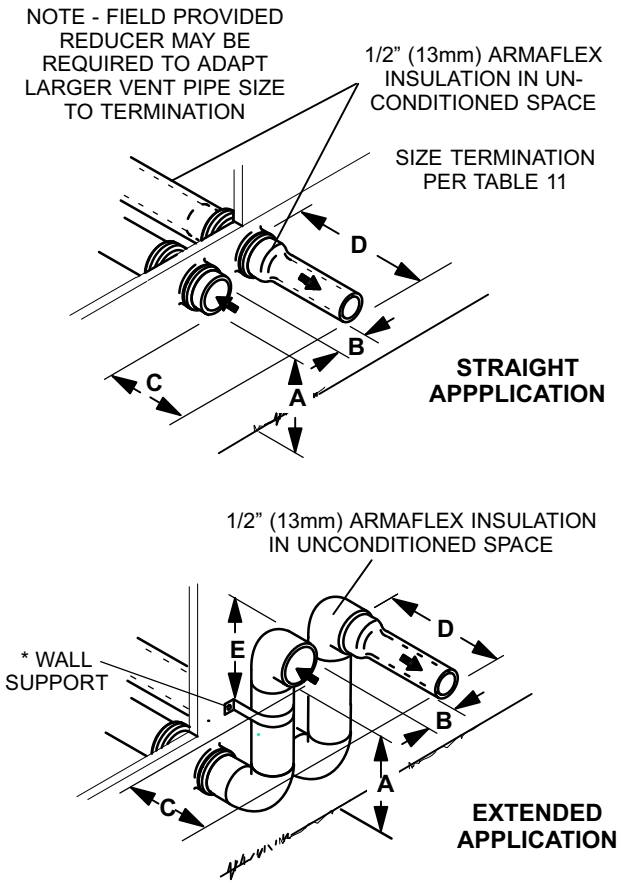
[1] The exhaust termination tee should be connected to the 2” or 3” PVC flue pipe as shown in the illustration. Do not use an accelerator in applications that include an exhaust termination tee. The accelerator is not required.

[2] As required. Flue gas may be acidic and may adversely affect some building materials. If a side wall vent termination is used and flue gases will impinge on the building materials, a corrosion-resistant shield (24 inches square) should be used to protect the wall surface. If optional tee is used, the protective shield is recommended. The shield should be constructed using wood, sheet metal or other suitable material. All seams, joints, cracks, etc. in affected area, should be sealed using an appropriate sealant.

[3]Exhaust pipe 45° elbow can be rotated to the side away from the combustion air inlet to direct exhaust away from adjacent property. The exhaust must never be directed toward the combustion air inlet.

FIGURE 27

FIELD FABRICATED WALL TERMINATION OR (15F74) WALL RING TERMINATION KIT



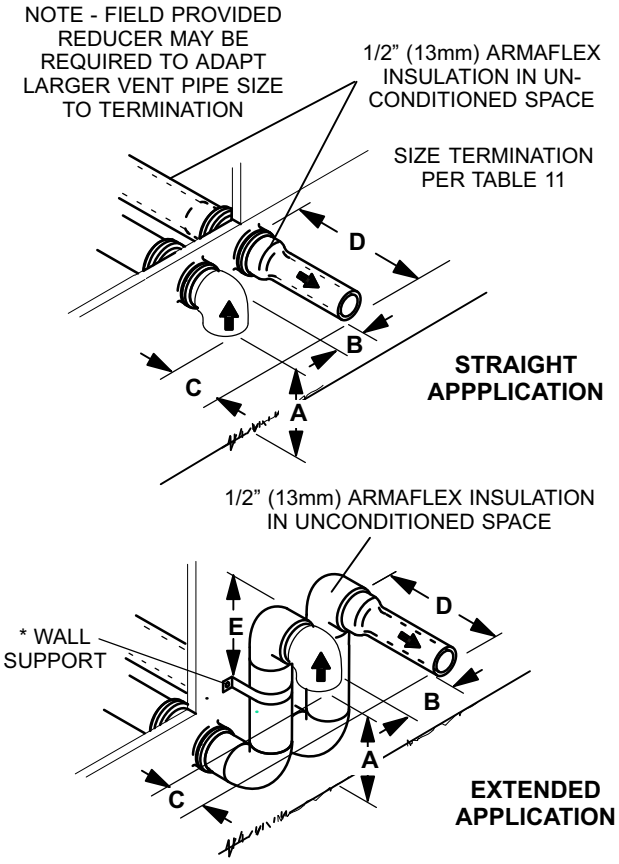
See venting table 10 for maximum venting lengths with this arrangement.

* Use wall support every 24" (610 mm). Use two wall supports if extension is greater than 24" (610 mm) but less than 48" (1219 mm). NOTE - One wall support must be 6" (152 mm) from top of each pipe (intake and exhaust)

	2" (51mm) Vent Pipe	3" (76mm) Vent Pipe
A-Minimum clearance above grade or average snow accumulation	12" (305MM)	12" (305MM)
B-Maximum horizontal separation between intake and exhaust	6" (152MM)	6" (152MM)
C-Minimum from end of exhaust to inlet of intake	8" (203MM)	8" (203MM)
D-Maximum exhaust pipe length	12" (305MM)	20" (508MM)
E-Maximum wall support distance from top of each pipe (intake/exhaust)	6" (152MM)	6" (152MM)

FIGURE 28

FIELD FABRICATED WALL TERMINATION OR (15F74) WALL RING TERMINATION KIT With INTAKE ELBOW

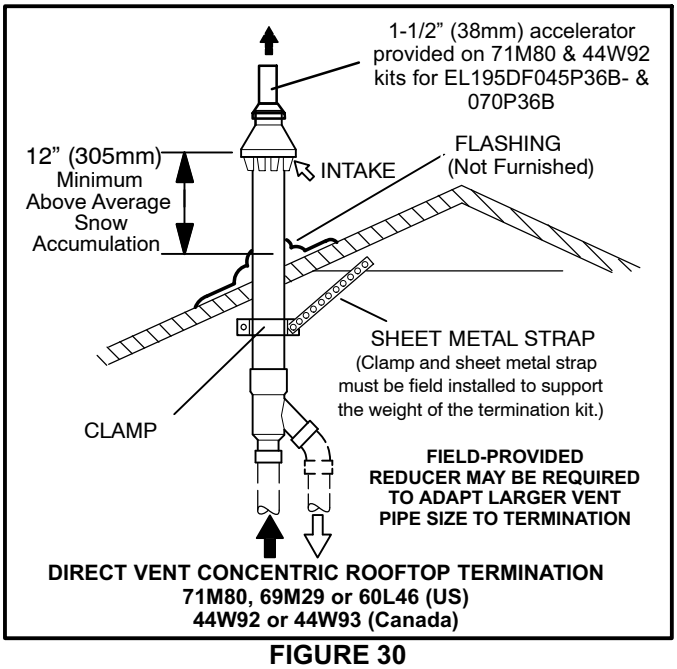


See venting table 10 for maximum venting lengths with this arrangement.

* Use wall support every 24" (610 mm). Use two wall supports if extension is greater than 24" (610 mm) but less than 48" (1219 mm). NOTE - One wall support must be 6" (152 mm) from top of each pipe (intake and exhaust)

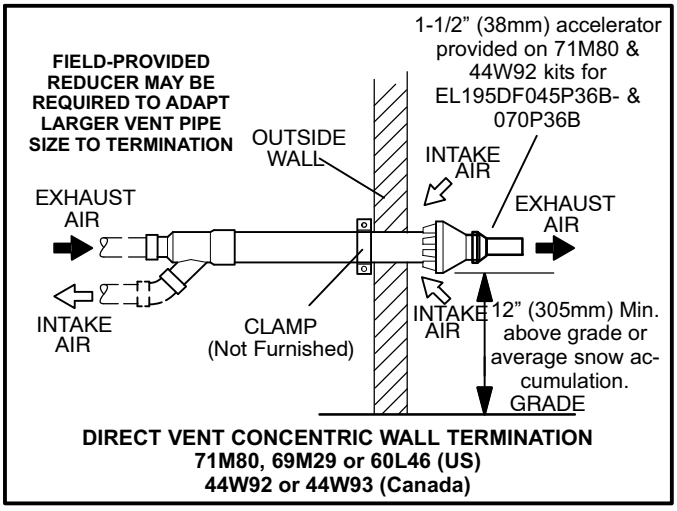
	2" (51mm) Vent Pipe	3" (76mm) Vent Pipe
A-Minimum clearance above grade or average snow accumulation	12" (305MM)	12" (305MM)
B-Maximum horizontal separation between intake and exhaust	6" (152MM)	6" (152MM)
C-Minimum from end of exhaust to inlet of intake	6" (152MM)	6" (152MM)
D-Maximum exhaust pipe length	12" (305MM)	20" (508MM)
E-Maximum wall support distance from top of each pipe (intake/exhaust)	6" (152MM)	6" (152MM)

FIGURE 29


1-1/2" (38mm) accelerator provided on 71M80 & 44W92 kits for EL195DF045P36B- & 070P36B
12" (305mm) Minimum Above Average Snow Accumulation
INTAKE
FLASHING (Not Furnished)
SHEET METAL STRAP
(Clamp and sheet metal strap must be field installed to support the weight of the termination kit.)
CLAMP
FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION

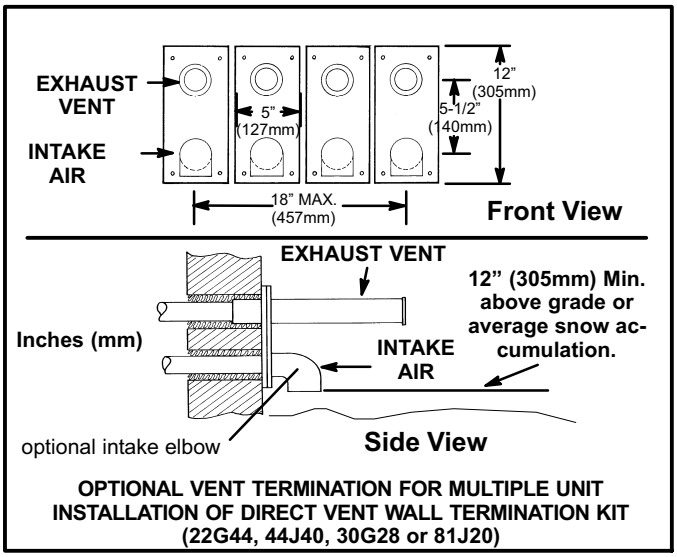
DIRECT VENT CONCENTRIC ROOFTOP TERMINATION
71M80, 69M29 or 60L46 (US)
44W92 or 44W93 (Canada)

FIGURE 30


FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION
1-1/2" (38mm) accelerator provided on 71M80 & 44W92 kits for EL195DF045P36B- & 070P36B
OUTSIDE WALL
INTAKE AIR
EXHAUST AIR
EXHAUST AIR
INTAKE AIR
CLAMP (Not Furnished)
INTAKE AIR
12" (305mm) Min. above grade or average snow accumulation.
GRADE

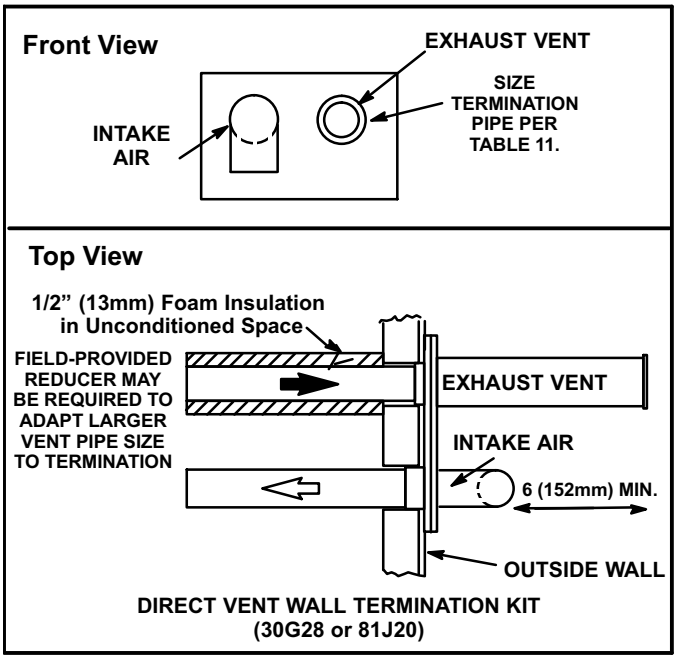
DIRECT VENT CONCENTRIC WALL TERMINATION
71M80, 69M29 or 60L46 (US)
44W92 or 44W93 (Canada)

FIGURE 31



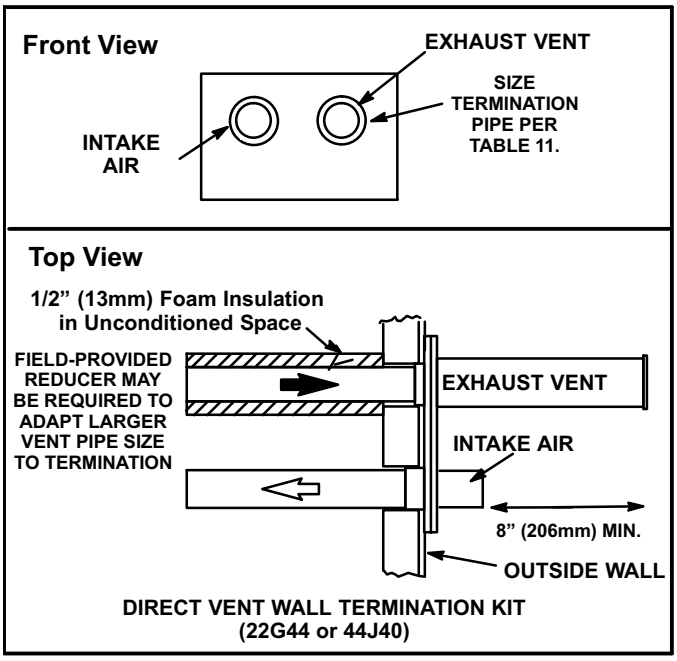
OPTIONAL VENT TERMINATION FOR MULTIPLE UNIT INSTALLATION OF DIRECT VENT WALL TERMINATION KIT
(22G44, 44J40, 30G28 or 81J20)

FIGURE 32



DIRECT VENT WALL TERMINATION KIT
(30G28 or 81J20)

FIGURE 33



DIRECT VENT WALL TERMINATION KIT
(22G44 or 44J40)

FIGURE 34

WALL TERMINATION KITS (CLOSE−COUPLE)
EXTENDED VENT FOR GRADE CLEARANCE
2 inch (51 mm) 22G44 (US)
3 inch (76 mm) 44J40 (US)

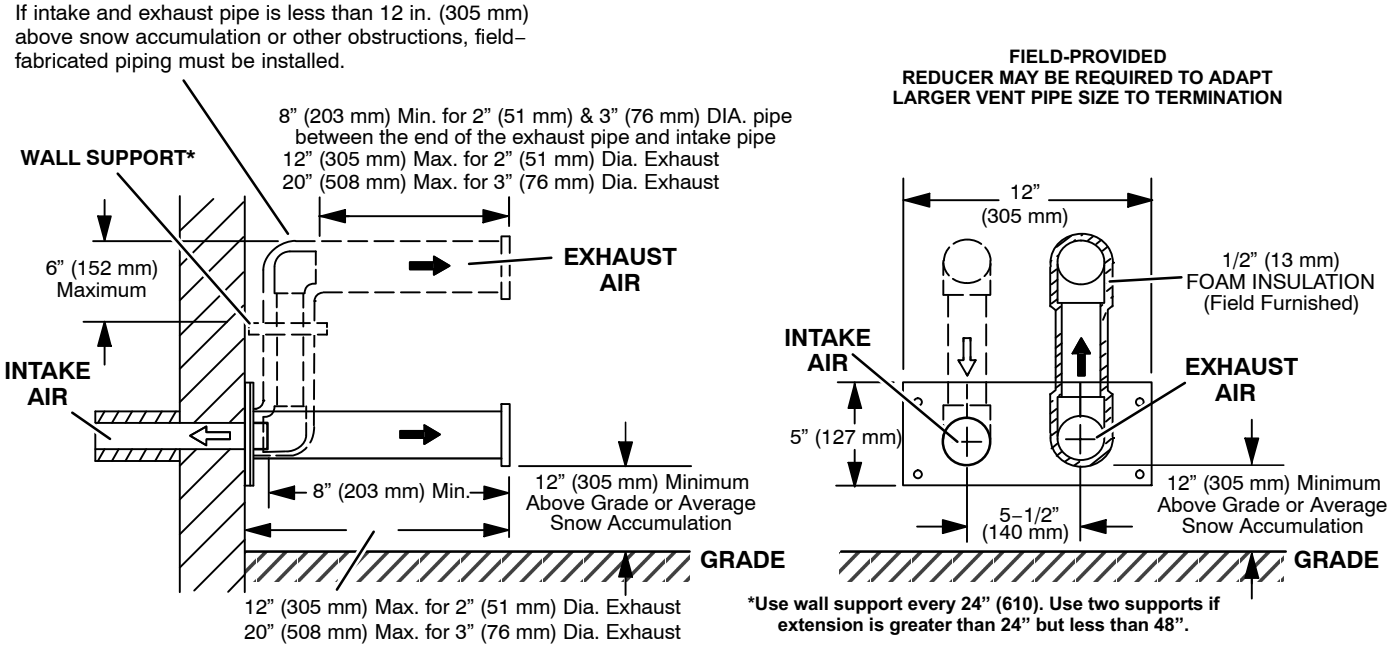

If intake and exhaust pipe is less than 12 in. (305 mm) above snow accumulation or other obstructions, field−fabricated piping must be installed.
8" (203 mm) Min. for 2" (51 mm) & 3" (76 mm) DIA. pipe between the end of the exhaust pipe and intake pipe
12" (305 mm) Max. for 2" (51 mm) Dia. Exhaust
20" (508 mm) Max. for 3" (76 mm) Dia. Exhaust
WALL SUPPORT*
6" (152 mm) Maximum
EXHAUST AIR
INTAKE AIR
8" (203 mm) Min.
12" (305 mm) Minimum Above Grade or Average Snow Accumulation
GRADE
12" (305 mm) Max. for 2" (51 mm) Dia. Exhaust
20" (508 mm) Max. for 3" (76 mm) Dia. Exhaust
FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION
12" (305 mm)
1/2" (13 mm) FOAM INSULATION (Field Furnished)
INTAKE AIR
EXHAUST AIR
5" (127 mm)
5−1/2" (140 mm)
12" (305 mm) Minimum Above Grade or Average Snow Accumulation
GRADE
*Use wall support every 24" (610). Use two supports if extension is greater than 24" but less than 48".

FIGURE 35

WALL TERMINATION KITS (CLOSE−COUPLE)
EXTENDED VENT FOR GRADE CLEARANCE
2 inch (51 mm) 30G28 (WTK Canada)
3 inch (76 mm) 81J20 (WTK Canada)
See Installation Instructions for additional information.

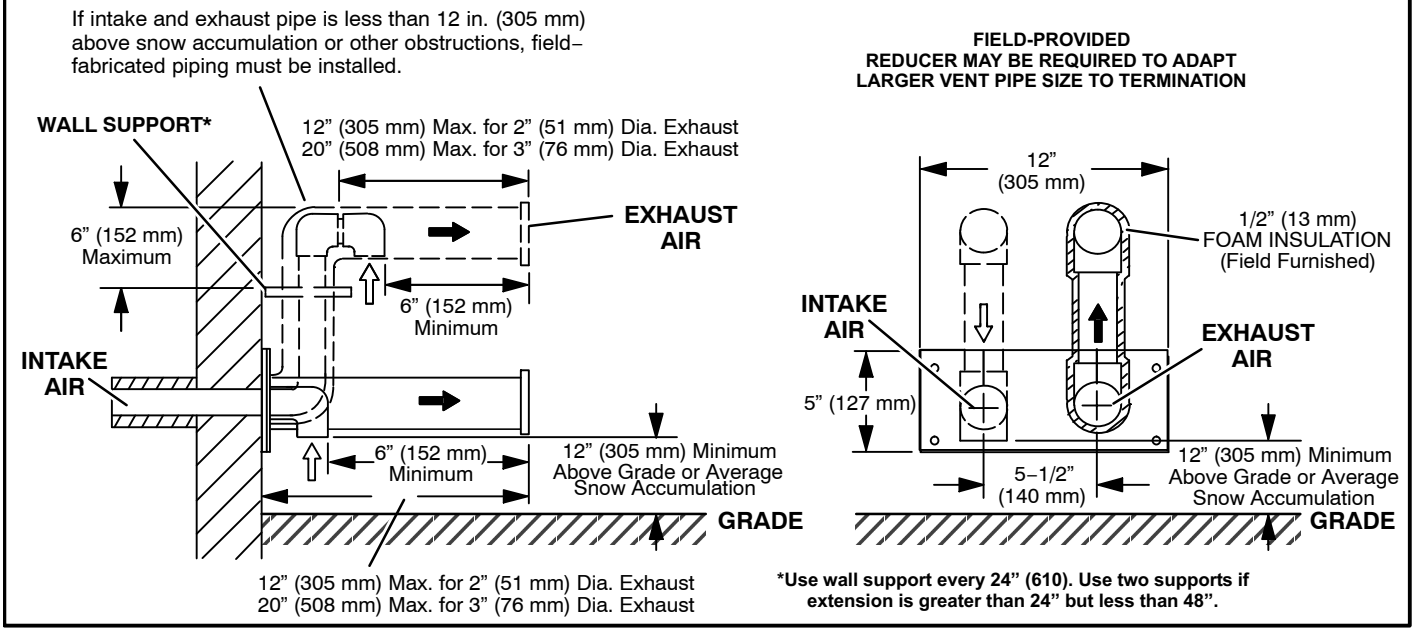

If intake and exhaust pipe is less than 12 in. (305 mm) above snow accumulation or other obstructions, field−fabricated piping must be installed.
WALL SUPPORT*
12" (305 mm) Max. for 2" (51 mm) Dia. Exhaust
20" (508 mm) Max. for 3" (76 mm) Dia. Exhaust
6" (152 mm) Maximum
EXHAUST AIR
6" (152 mm) Minimum
INTAKE AIR
6" (152 mm) Minimum
12" (305 mm) Minimum Above Grade or Average Snow Accumulation
GRADE
12" (305 mm) Max. for 2" (51 mm) Dia. Exhaust
20" (508 mm) Max. for 3" (76 mm) Dia. Exhaust
FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION
12" (305 mm)
1/2" (13 mm) FOAM INSULATION (Field Furnished)
INTAKE AIR
EXHAUST AIR
5" (127 mm)
5−1/2" (140 mm)
12" (305 mm) Minimum Above Grade or Average Snow Accumulation
GRADE
*Use wall support every 24" (610). Use two supports if extension is greater than 24" but less than 48".

FIGURE 36

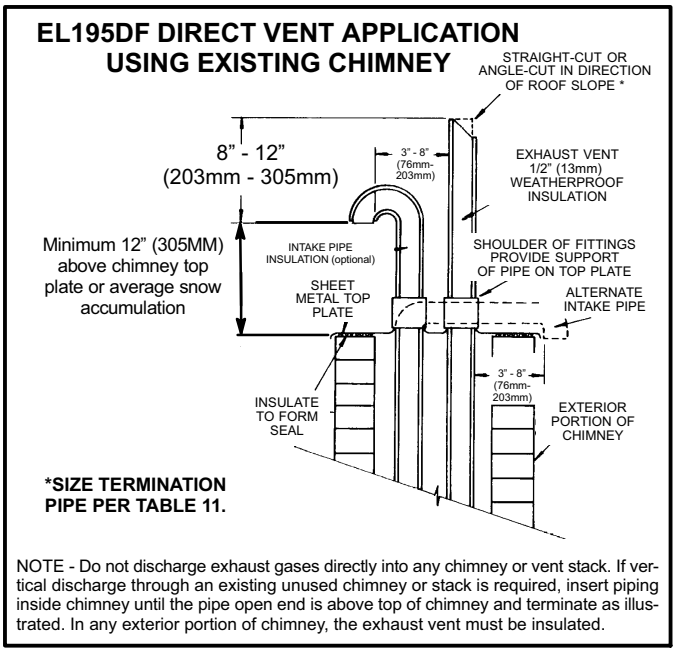

EL195DF DIRECT VENT APPLICATION
USING EXISTING CHIMNEY
STRAIGHT-CUT OR ANGLE-CUT IN DIRECTION OF ROOF SLOPE *
8" - 12" (203mm - 305mm)
3" - 8" (76mm-203mm)
EXHAUST VENT 1/2" (13mm) WEATHERPROOF INSULATION
Minimum 12" (305MM) above chimney top plate or average snow accumulation
INTAKE PIPE INSULATION (optional)
SHOULDER OF FITTINGS PROVIDE SUPPORT OF PIPE ON TOP PLATE
SHEET METAL TOP PLATE
ALTERNATE INTAKE PIPE
3" - 8" (76mm-203mm)
INSULATE TO FORM SEAL
EXTERIOR PORTION OF CHIMNEY
*SIZE TERMINATION PIPE PER TABLE 11.
NOTE - Do not discharge exhaust gases directly into any chimney or vent stack. If vertical discharge through an existing unused chimney or stack is required, insert piping inside chimney until the pipe open end is above top of chimney and terminate as illustrated. In any exterior portion of chimney, the exhaust vent must be insulated.

FIGURE 37

Details of Exhaust Piping Terminations for Non-Direct Vent Applications

Exhaust pipes may be routed either horizontally through an outside wall or vertically through the roof. In attic or closet installations, vertical termination through the roof is preferred. Figures 38 through 41 show typical terminations.

1. Exhaust piping must terminate straight out or up as shown. The termination pipe must be sized as listed in table 11.The specified pipe size ensures proper velocity required to move the exhaust gases away from the building.
2. On field supplied terminations for side wall exit, exhaust piping may extend a maximum of 12 inches (305mm) for 2" PVC and 20 inches (508mm) for 3" (76mm) PVC beyond the outside wall. See figure 39.

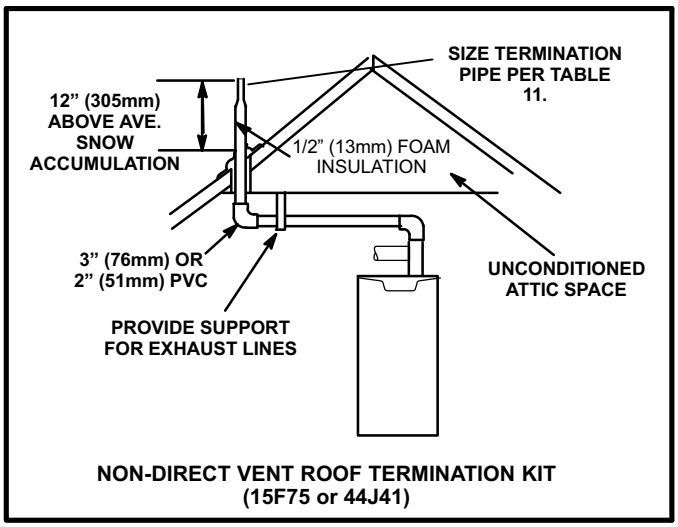

SIZE TERMINATION PIPE PER TABLE 11.
12" (305mm) ABOVE AVE. SNOW ACCUMULATION
1/2" (13mm) FOAM INSULATION
3" (76mm) OR 2" (51mm) PVC
UNCONDITIONED ATTIC SPACE
PROVIDE SUPPORT FOR EXHAUST LINES
NON-DIRECT VENT ROOF TERMINATION KIT (15F75 or 44J41)

FIGURE 38

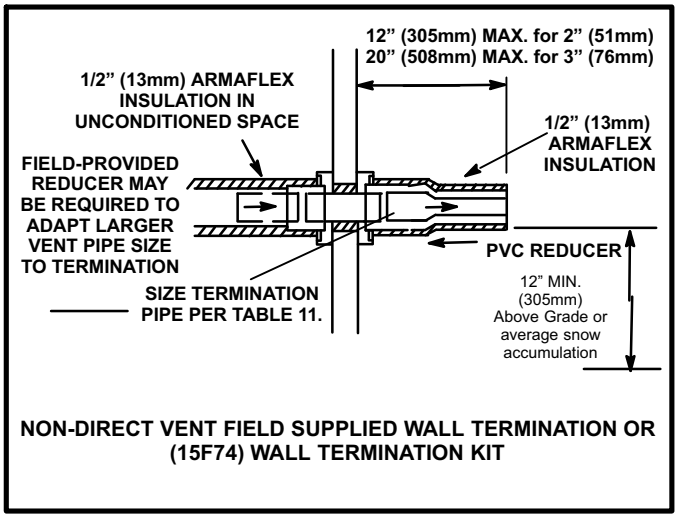

12" (305mm) MAX. for 2" (51mm)
20" (508mm) MAX. for 3" (76mm)
1/2" (13mm) ARMAFLEX INSULATION IN UNCONDITIONED SPACE
1/2" (13mm) ARMAFLEX INSULATION
FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION
PVC REDUCER
SIZE TERMINATION PIPE PER TABLE 11.
12" MIN. (305mm) Above Grade or average snow accumulation
NON-DIRECT VENT FIELD SUPPLIED WALL TERMINATION OR (15F74) WALL TERMINATION KIT

FIGURE 39

3. If exhaust piping must be run up a side wall to position above snow accumulation or other obstructions, piping must be supported every 24 inches (610mm) as shown in figure 40. When exhaust piping must be run up an outside wall, any reduction in exhaust pipe size must be done after the final elbow.

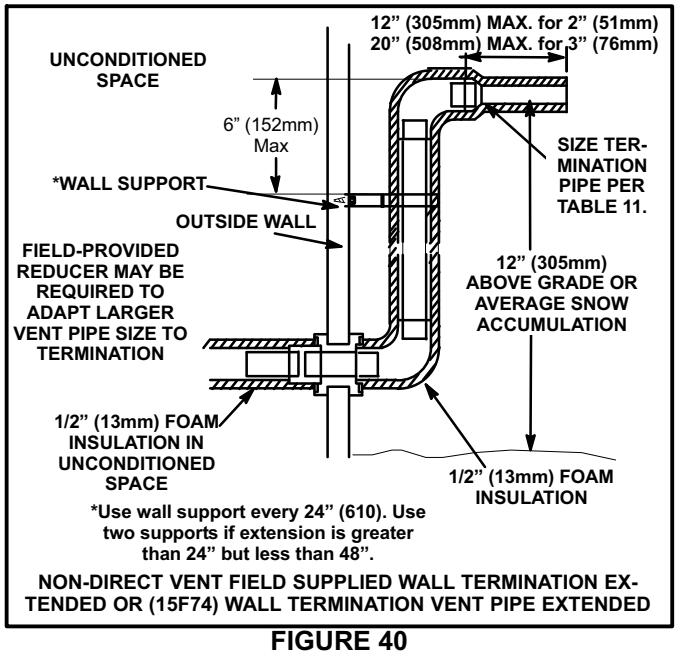

12" (305mm) MAX. for 2" (51mm)
20" (508mm) MAX. for 3" (76mm)
UNCONDITIONED SPACE
6" (152mm) Max
*WALL SUPPORT
OUTSIDE WALL
FIELD-PROVIDED REDUCER MAY BE REQUIRED TO ADAPT LARGER VENT PIPE SIZE TO TERMINATION
SIZE TERMINATION PIPE PER TABLE 11.
12" (305mm) ABOVE GRADE OR AVERAGE SNOW ACCUMULATION
1/2" (13mm) FOAM INSULATION IN UNCONDITIONED SPACE
1/2" (13mm) FOAM INSULATION
*Use wall support every 24" (610). Use two supports if extension is greater than 24" but less than 48".
NON-DIRECT VENT FIELD SUPPLIED WALL TERMINATION EXTENDED OR (15F74) WALL TERMINATION VENT PIPE EXTENDED

FIGURE 40

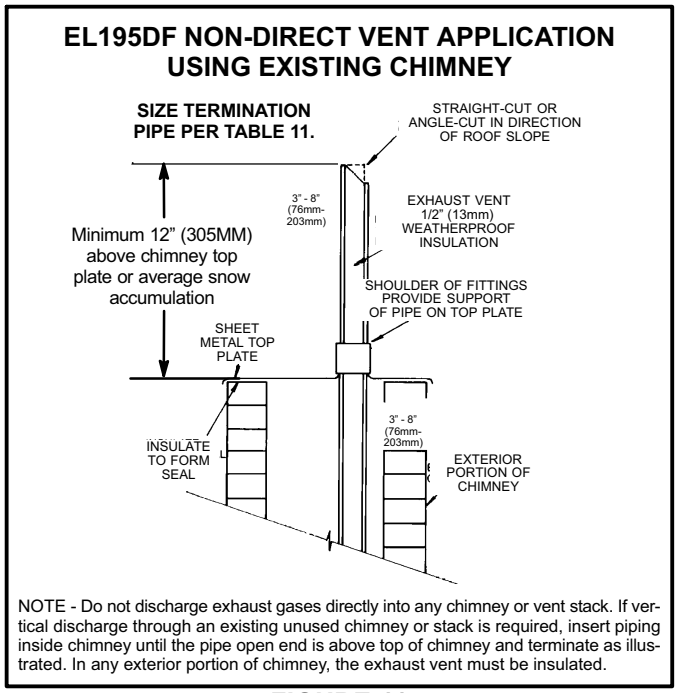

EL195DF NON-DIRECT VENT APPLICATION USING EXISTING CHIMNEY
SIZE TERMINATION PIPE PER TABLE 11.
STRAIGHT-CUT OR ANGLE-CUT IN DIRECTION OF ROOF SLOPE
3" - 8" (76mm-203mm)
EXHAUST VENT 1/2" (13mm) WEATHERPROOF INSULATION
Minimum 12" (305MM) above chimney top plate or average snow accumulation
SHOULDER OF FITTINGS PROVIDE SUPPORT OF PIPE ON TOP PLATE
SHEET METAL TOP PLATE
INSULATE TO FORM SEAL
3" - 8" (76mm-203mm)
EXTERIOR PORTION OF CHIMNEY
NOTE - Do not discharge exhaust gases directly into any chimney or vent stack. If vertical discharge through an existing unused chimney or stack is required, insert piping inside chimney until the pipe open end is above top of chimney and terminate as illustrated. In any exterior portion of chimney, the exhaust vent must be insulated.

FIGURE 41

Condensate Piping

This unit is designed for either right- or left-side exit of condensate piping. Refer to figures 42 and 43 for condensate trap locations.

***NOTE** - If necessary the condensate trap may be installed up to 5' away from the furnace. Use PVC pipe to connect trap to furnace condensate outlet. Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.*

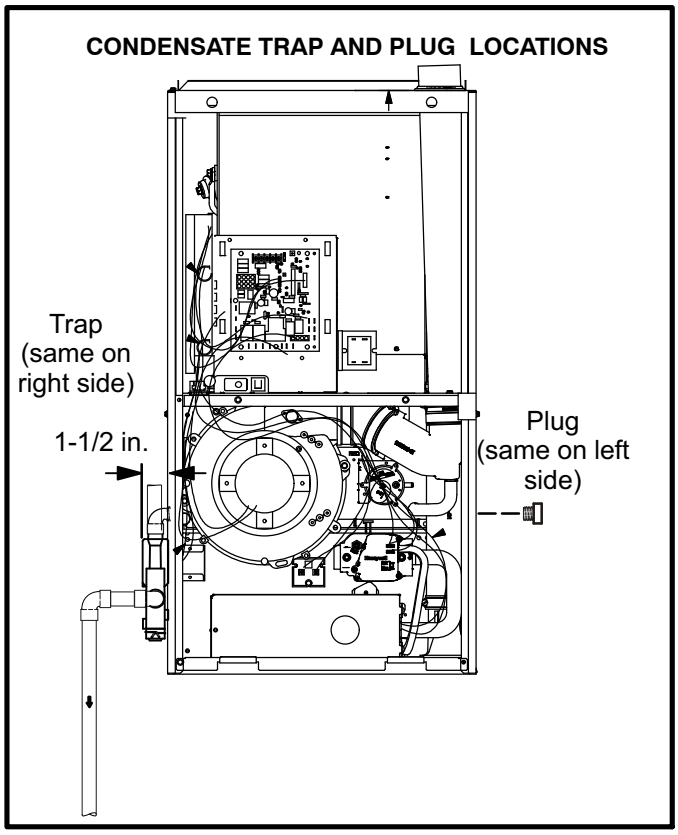


FIGURE 42

1 - Determine which side condensate piping will exit the unit, location of trap, field-provided fittings and length of PVC pipe required to reach available drain.

2 - Use a 3/8 allen wrench and remove plug (figure 42) from the cold end header box at the appropriate location on the side of the unit. Install field-provided 1/2" NPT male fitting into cold end header box. Use teflon tape or appropriate pipe dope.

3 - Install the cap over the clean out opening at the base of the trap. Secure with clamp. See figure 47.

4 - Install drain trap using appropriate PVC fittings, glue all joints. Glue the provided drain trap as shown in figure 47. Route the condensate line to an open drain.

5 - Figure 44 shows the furnace and evaporator coil using a separate drain. If necessary, the condensate line from the furnace and evaporator coil can drain together. See figures 45 and 46. The field provided vent must be a minimum 1" to a maximum 2" length above the condensate drain outlet connection.

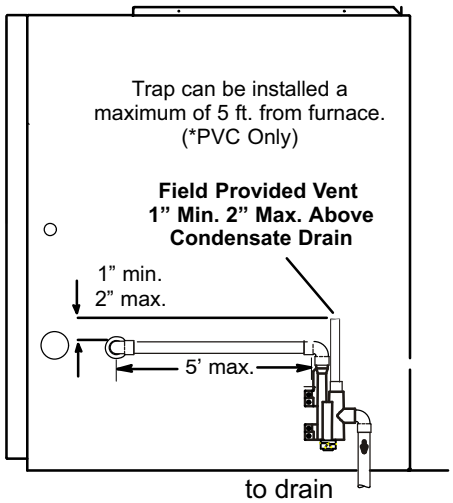
***NOTE** - If necessary the condensate trap may be installed up to 5 feet away from the furnace. Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.*

***NOTE** - Vinyl tubing may be used for condensate drain. Tubing must be 1-1/4" OD X 1" ID and should be attached to the drain on the trap using a hose clamp.*

6 - If unit will be started immediately upon completion of installation, prime trap per procedure outlined in Unit Start-Up section.

Condensate line must slope downward away from the trap to drain. If drain level is above condensate trap, condensate pump must be used. Condensate drain line should be routed within the conditioned space to avoid freezing of condensate and blockage of drain line. If this is not possible, a heat cable kit may be used on the condensate trap and line. Heat cable kit is available from Lennox in various lengths; 6 ft. (1.8m) - kit no. 26K68; 24 ft. (7.3m) - kit no. 26K69; and 50 ft. (15.2m) - kit no. 26K70.

CONDENSATE TRAP LOCATION
(shown with right side exit of condensation)


Trap can be installed a maximum of 5 ft. from furnace. (*PVC Only)
Field Provided Vent 1" Min. 2" Max. Above Condensate Drain
1" min.
2" max.
5' max.
to drain

**Piping from furnace must slope down a minimum of 1/4" per ft. toward trap.*

FIGURE 43

EL195DF with Evaporator Coil
Using a Separate Drain

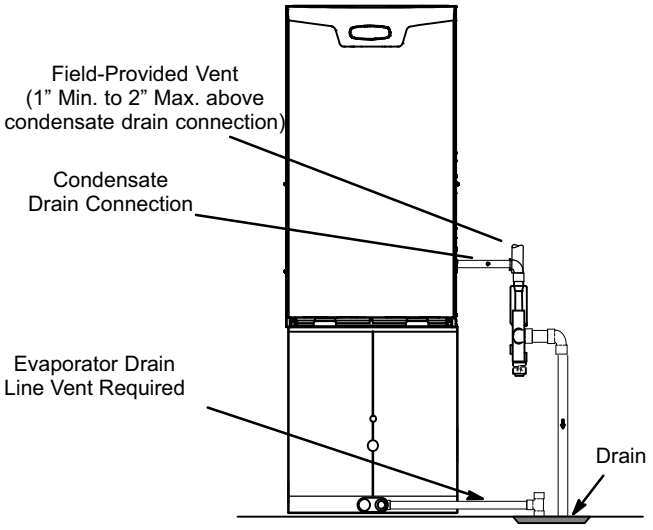

Field-Provided Vent (1" Min. to 2" Max. above condensate drain connection)
Condensate Drain Connection
Evaporator Drain Line Vent Required
Drain

FIGURE 44

IMPORTANT

When combining the furnace and evaporator coil drains together, the A/C condensate drain outlet must be vented to relieve pressure in order for the furnace pressure switch to operate properly.

EL195DF with Evaporator Coil
Using a Common Drain

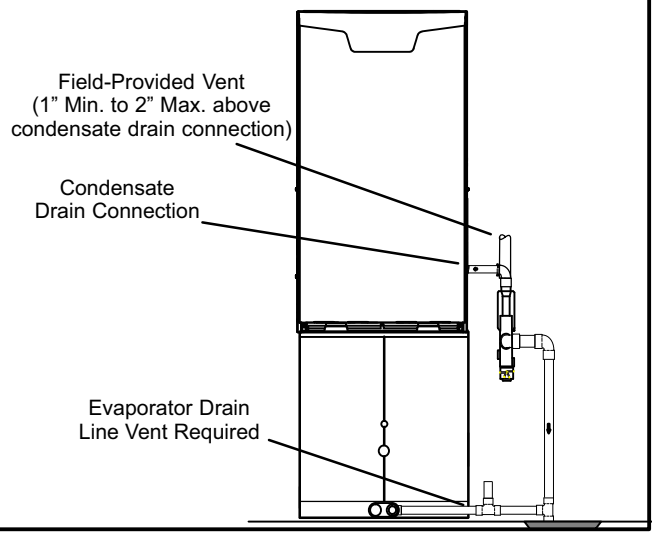

Field-Provided Vent (1" Min. to 2" Max. above condensate drain connection)
Condensate Drain Connection
Evaporator Drain Line Vent Required

FIGURE 45

Condensate Trap With Optional Overflow Switch

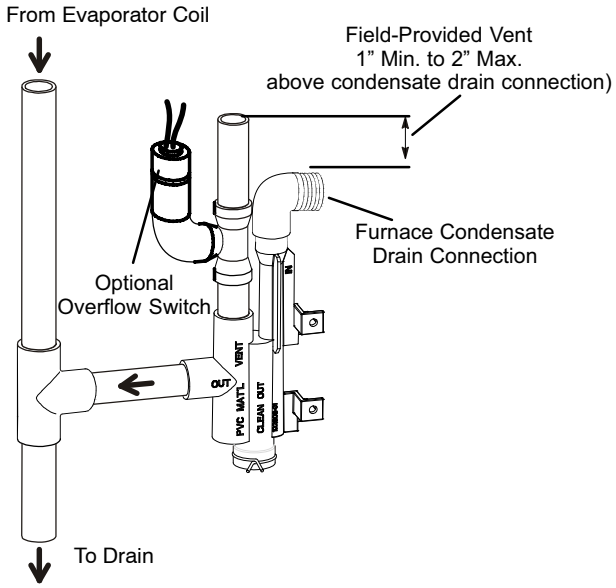


FIGURE 46

CAUTION

Do not use copper tubing or existing copper condensate lines for drain line.

TRAP / DRAIN ASSEMBLY USING 1/2” PVC OR 3/4” PVC

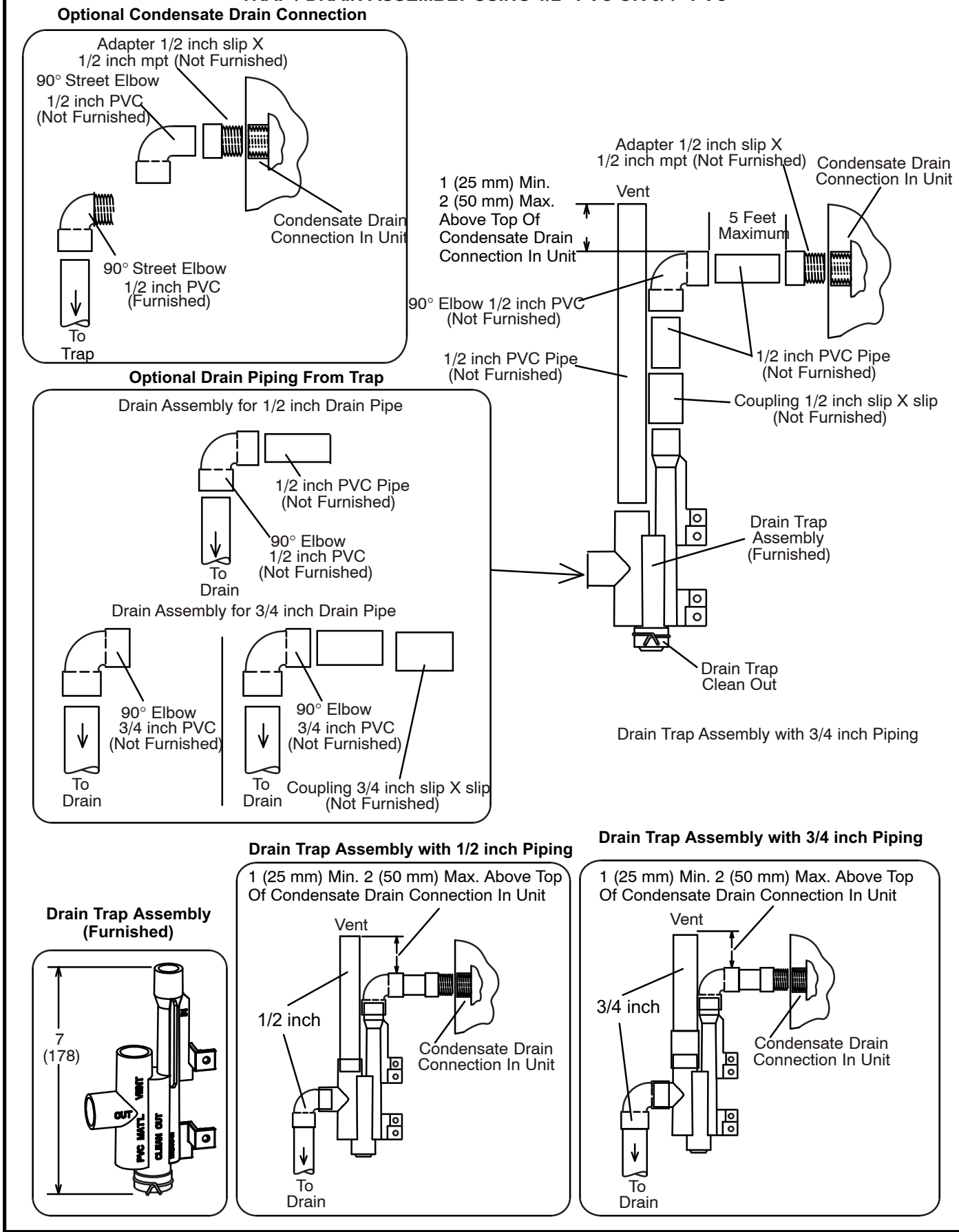


FIGURE 47

III-START-UP

A-Preliminary and Seasonal Checks

1 - Inspect electrical wiring, both field and factory installed for loose connections. Tighten as required.

2 - Check voltage at disconnect switch. Voltage must be within range listed on the nameplate. If not, consult the power company and have voltage condition corrected before starting unit.

3 - Inspect condition of condensate traps and drain assembly. Disassemble and clean seasonally.

B-Heating Start-Up

BEFORE LIGHTING the unit, smell all around the furnace area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

The gas valve on the EL195DF is equipped with a gas control switch. Use only your hand to move the switch. Never use tools. If the the switch will not move by hand, replace the valve. Do not try to repair it. Force or attempted repair may result in a fire or explosion.

Placing the furnace into operation:

EL195DF units are equipped with a SureLight ignition system. Do not attempt to manually light burners on this furnace. Each time the thermostat calls for heat, the burners will automatically light The ignitor does not get hot when there is no call for heat on units with SureLight™ ignition system.

Priming Condensate Trap

The condensate trap should be primed with water prior to start-up to ensure proper condensate drainage. Either pour 10 fl. oz. (300 ml) of water into the trap, or follow these steps to prime the trap:

1 - Follow the lighting instructions to place the unit into operation.

2 - Set the thermostat to initiate a heating demand.

3 - Allow the burners to fire for approximately 3 minutes.

4 - Adjust the thermostat to deactivate the heating demand.

5 - Wait for the combustion air inducer to stop. Set the thermostat to initiate a heating demand and again allow the burners to fire for approximately 3 minutes.

6 - Adjust the thermostat to deactivate the heating demand and again wait for the combustion air inducer to stop. At this point, the trap should be primed with sufficient water to ensure proper condensate drain operation.

⚠WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or death.

Gas Valve Operation (Figure 48)

1 - **STOP**! Read the safety information at the beginning of this section.

2 - Set the thermostat to the lowest setting.

3 - Turn off all electrical power to the unit.

4 - This furnace is equipped with an ignition device which automatically lights the burners. Do **not** try to light the burners by hand.

5 - Remove the upper access panel.

6 - Move gas valve switch to **OFF.** See figure 48.

7 - Wait five minutes to clear out any gas. If you then smell gas, STOP! Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you do not smell gas go to next step.

8 - Move gas valve switch to **ON.** See figure 48.

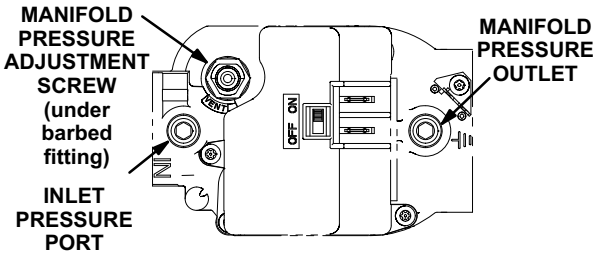


FIGURE 48

9 - Replace the upper access panel.

10- Turn on all electrical power to to the unit.

11- Set the thermostat to desired setting.

***NOTE** - When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.*

12- If the appliance will not operate, follow the instructions "Turning Off Gas to Unit" and call your service technician or gas supplier.

Turning Off Gas to Unit

1 - Set the thermostat to the lowest setting.

2 - Turn off all electrical power to the unit if service is to be performed.

3 - Remove the upper access panel.

4 - Move gas valve switch to **OFF.**

5 - Replace the upper access panel.

Failure To Operate

If the unit fails to operate, check the following:

1 - Is the thermostat calling for heat?

2 - Are access panels securely in place?

3 - Is the main disconnect switch closed?

4 - Is there a blown fuse or tripped breaker?

5 - Is the filter dirty or plugged? Dirty or plugged filters will cause the limit control to shut the unit off.

6 - Is gas turned on at the meter?

7 - Is the manual main shut-off valve open?

8 - Is the internal manual shut-off valve open?

9 - Is the unit ignition system in lockout? If the unit locks out again, inspect the unit for blockages.

IV-HEATING SYSTEM SERVICE CHECKS

A-C.S.A. Certification

All units are C.S.A. design certified without modifications. Refer to the EL195DF Operation and Installation Instruction Manual Information.

B-Gas Piping

⚠ CAUTION

If a flexible gas connector is required or allowed by the authority that has jurisdiction, black iron pipe shall be installed at the gas valve and extend outside the furnace cabinet. The flexible connector can then be added between the black iron pipe and the gas supply line.

Gas supply piping should not allow more than 0.5"W.C. drop in pressure between gas meter and unit. Supply gas pipe must not be smaller than unit gas connection.

Compounds used on gas piping threaded joints should be resistant to action of liquefied petroleum gases.

C-Testing Gas Piping

⚠ IMPORTANT

In case emergency shutdown is required, turn off the main shut-off valve and disconnect the main power to unit. These controls should be properly labeled by the installer.

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 0.5psig (14" W.C.). See figure 49.

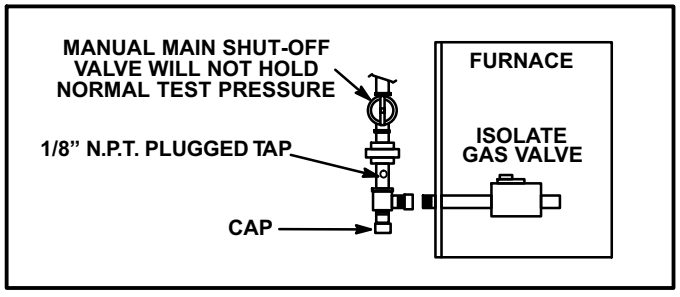


FIGURE 49

When checking piping connections for gas leaks, use preferred means. Kitchen detergents can cause harmful corrosion on various metals used in gas piping. Use of a specialty Gas Leak Detector is strongly recommended. It is available through Lennox under part number 31B2001. See Corp. 8411-L10, for further details.

⚠ WARNING

Do not use matches, candles, flame or any other source of ignition to check for gas leaks.

D-Testing Gas Supply Pressure

When testing supply gas pressure, use the 1/8" N.P.T. plugged tap or pressure post located on the gas valve to facilitate test gauge connection. See figure 48. Check gas line pressure with unit firing at maximum rate. Low pressure may result in erratic operation or underfire. High pressure can result in permanent damage to gas valve or overfire.

On multiple unit installations, each unit should be checked separately, with and without units operating. Supply pressure must fall within range listed in table 13.

E-Check Manifold Pressure

After line pressure has been checked and adjusted, check manifold pressure. Move pressure gauge to outlet pressure tap located on unit gas valve (GV1).

Checks of manifold pressure are made as verification of proper regulator adjustment.

⚠ IMPORTANT

For safety, connect a shut-off valve between the manometer and the gas tap to permit shut off of gas pressure to the manometer.

1 - Remove the threaded plug from the outlet side of the gas valve and install a field-provided barbed fitting. Connect to a manometer to measure manifold pressure.

2 - Start unit and allow 5 minutes for unit to reach steady state.

3 - While waiting for the unit to stabilize, observe the flame. Flame should be stable and should not lift from burner. Natural gas should burn blue.

4 - After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in table 13.

***NOTE** - Shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to remove barbed fitting and replace threaded plug.*

TABLE 13
Manifold and Supply Pressure (Outlet) inches w.c.

Fuel	Model Input Sizes	Manifold Pressure in.wg.	Supply Pressure in.wg.	
			Min.	Max.
Nat	All sizes	3.5	4.5	10.0
LP/Propane	All sizes	10.0	11.0	13.0

F- Proper Gas Flow (Approximate)

Gas Flow (Approximate)

TABLE 14

GAS METER CLOCKING CHART				
EL195 Unit	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft DIAL
-045	80	160	200	400
-070	55	110	136	272
-090	41	82	102	204
-110	33	66	82	164
Natural-1000 btu/cu ft LP-2500 btu/cu ft				

***NOTE** - To obtain accurate reading, shut off all other gas appliances connected to meter.*

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for **two** revolutions of gas through the meter. (Two revolutions assures a more accurate time). **Divide by two** and compare to time in table 14. If manifold pressure matches table 13 and rate is incorrect, check gas orifices for proper size and restriction. Remove temporary gas meter if installed.

G- Proper Combustion

Furnace should operate at least 15 minutes with correct manifold pressure and gas flow rate before checking combustions. Take sample beyond the flue outlet and compare to table 15.

TABLE 15

EL195 Unit	CO_2% For Nat	CO_2% For LP
-045	7.2 - 8.2	8.6 - 9.6
-070		
-090		
-110		
The maximum carbon monoxide reading should not exceed 50 ppm.		

H- High Altitude

***NOTE** - In Canada, certification for installations at elevations over 4500 feet (1372 m) is the jurisdiction of local authorities.*

EL195DF units require no manifold pressure adjustments for operation at altitudes up to 10,000 feet (3048 m) above sea level. Units installed at altitude of 4501 - 10,000 feet (1373 to 3048m) require a pressure switch change which can be ordered separately. Table 16 lists conversion kit and pressure switch requirements at varying altitudes.

The combustion air pressure switch is factory-set and requires no adjustment.

***NOTE** - A natural to LP/propane gas changeover kit is necessary to convert this unit. Refer to the changeover kit installation instruction for the conversion procedure.*

TABLE 16
Conversion Kit and Pressure Switch Requirements at Varying Altitudes

EL195 Unit	Natural to LP/Propane	High Altitude Natural Burner Orifice Kit	High Altitude LP/Propane Burner Orifice Kit	High Altitude Pressure Switch	
	0 - 7500 ft (0 - 2286m)	7501 - 10,000 ft (2286 - 3038m)	7501 - 10,000 ft (2286 - 3038m)	4501 - 7500 ft (1373 - 2286m)	7501 -10,000 ft (2286 - 3048m)
-045	*69W73	73W37	*68W68	No Change	80W60
-070				80W66	80W59
-090				80W65	80W59
-110				80W66	80W59

* Conversion requires installation of a gas valve manifold spring which is provided with the gas conversion kit.
Pressure switch is factory set. No adjustment necessary. All models use the factory-installed pressure switch from 0-4500 feet (0-1370 m).

I- Proper Ground and Voltage

A poorly grounded furnace can contribute to premature ignitor failure. Use the following procedure to check for ground and voltage to the integrated control.

1 - Measure the AC voltage between Line Neutral (spade terminals) and “C” terminal (low voltage terminal block) on the integrated control. See figure 50. A wide variation in the voltage between Line Neutral and “C” as a function of load indicates a poor or partial ground. Compare the readings to the table below. If the readings exceed the maximum shown in table 1, make repairs before operating the furnace.

2 - In addition, measure the AC voltage from Line Hot to Line Neutral (spade terminals) on the integrated control. See figure 50. This voltage should be in the range of 97 to 132 Vac

TABLE 17

Furnace Status	Measurement VAC	
	Expected	Maximum
Power On Furnace Idle	0.3	2
CAI / Ignitor Energized	0.75	5
Indoor Blower Energized	Less than 2	10

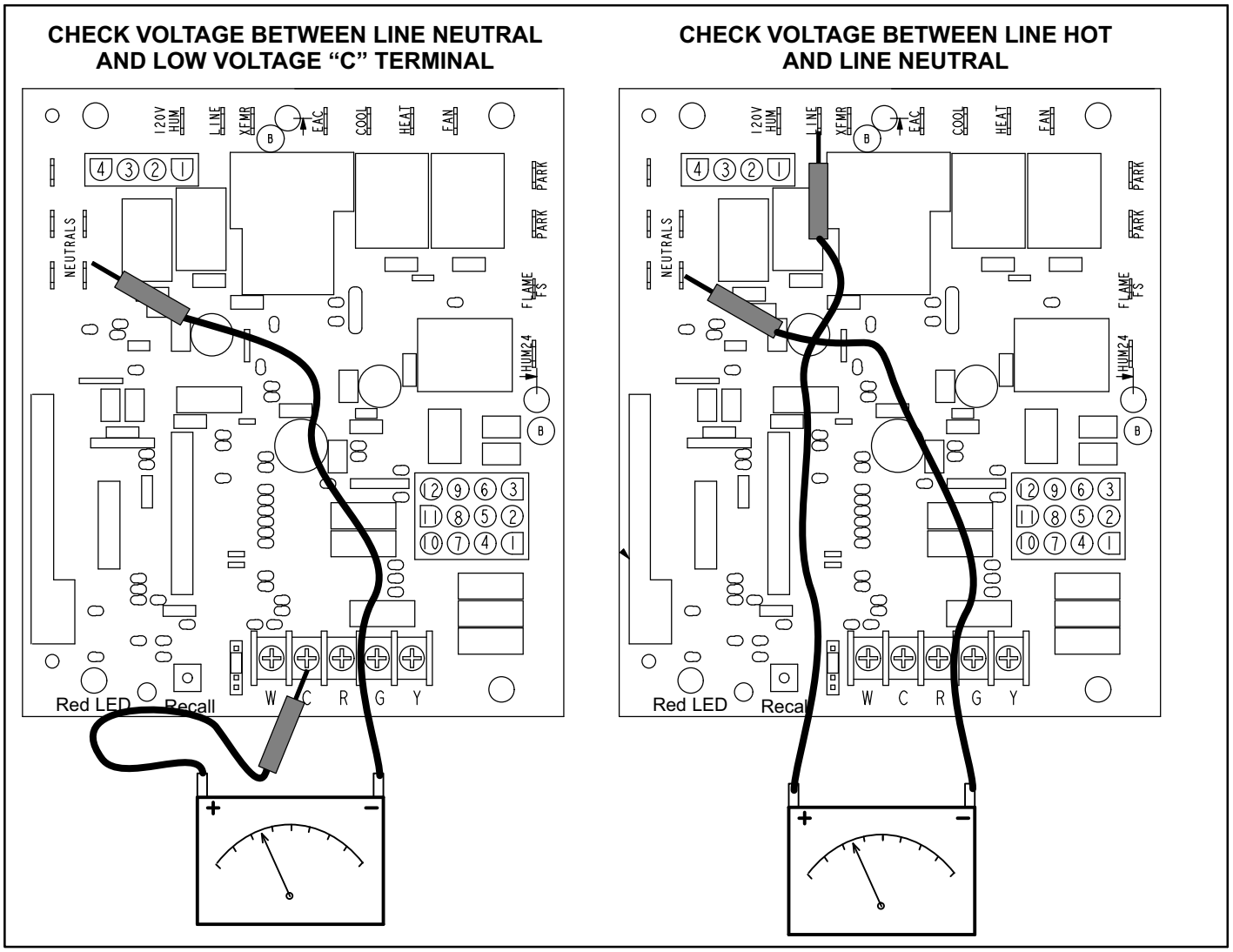


FIGURE 50

V-TYPICAL OPERATING CHARACTERISTICS

A-Blower Operation and Adjustment1

NOTE- The following is a generalized procedure and does not apply to all thermostat controls.

1 - Blower operation is dependent on thermostat control system.

2 - Generally, blower operation is set at thermostat subbase fan switch. With fan switch in ON position, blower operates continuously. With fan switch in AUTO position, blower cycles with demand or runs continuously while heating or cooling circuit cycles.

3 - Depending on the type of indoor thermostat, blower and entire unit will be off when the system switch is in OFF position.

B-Temperature Rise (Figure 51)

Temperature rise for EL195UH units depends on unit input, blower speed, blower horsepower and static pressure as marked on the unit rating plate. The blower speed must be set for unit operation within the range of "TEMP. RISE °F" listed on the unit rating plate.

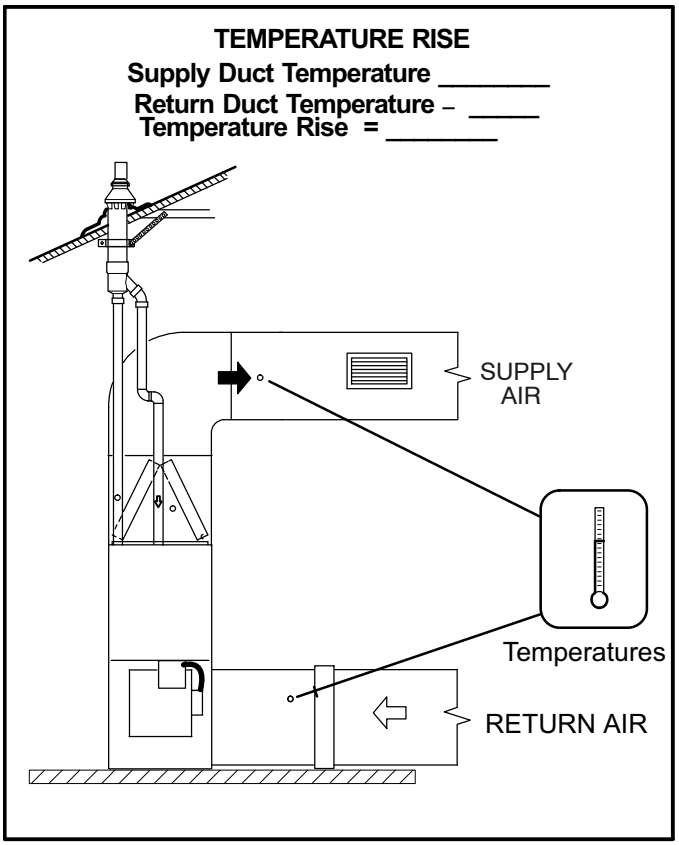


FIGURE 51

C-External Static Pressure

1 - Tap locations shown in figure 52.

2 - Punch a 1/4" diameter hole in supply and return air plenums. Insert manometer hose flush with inside edge of hole or insulation. Seal around the hose with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. On ducted systems, connect the other end of manometer to the return duct as above.

3 - With only the blower motor running and the evaporator coil dry, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements. For heating speed external static pressure drop must not be more than 0.5" W.C. For cooling speed external static pressure drop must not be more than 0.8" W.C.

4 - Seal the hole when the check is complete.

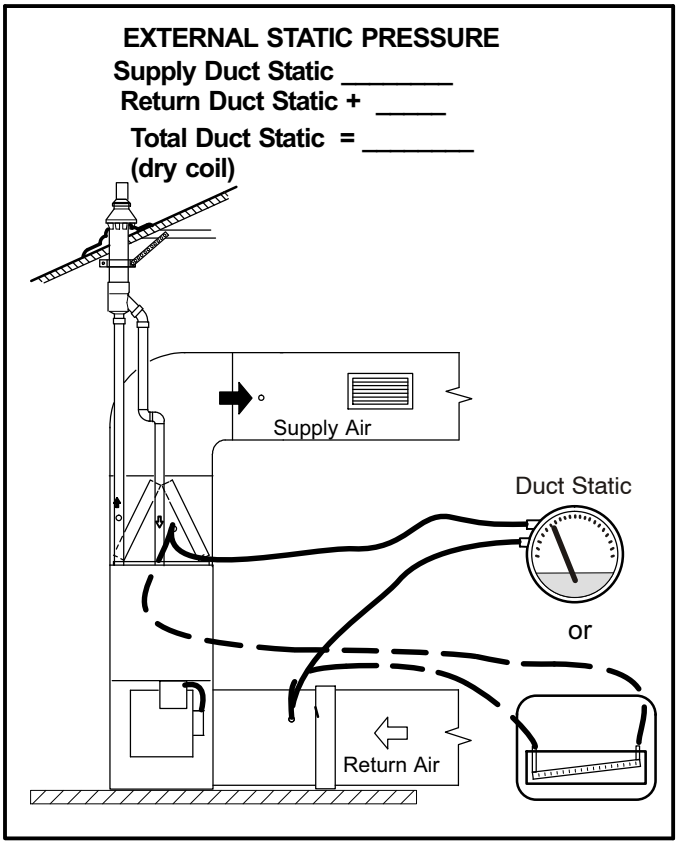


FIGURE 53

D-Blower Speed Taps

Blower speed tap changes are made on the integrated control. See figure 4. The heating tap is connected to the "HEAT" terminal and the cooling tap is connected to the "COOL" terminal. On all units the continuous blower tap is connected to the "FAN" terminal. Unused taps must be secured on two dummy terminals labeled "PARK. To change out existing speed tap, turn off power and switch out speed tap with tap connected to "PARK". See blower speed tap table on unit diagram for motor tap colors for each speed.

VI-MAINTENANCE

⚠WARNING

ELECTRICAL SHOCK, FIRE, OR EXPLOSION HAZARD.

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.
Improper servicing could result in dangerous operation, serious injury, death, or property damage.
Before servicing, disconnect all electrical power to furnace.
When servicing controls, label all wires prior to disconnecting. Take care to reconnect wires correctly.
Verify proper operation after servicing.

At the beginning of each heating season, system should be checked as follows by a qualified service technician:

Blower

Check the blower wheel for debris and clean if necessary. The blower motors are prelubricated for extended bearing life. No further lubrication is needed.

⚠WARNING

The blower access panel must be securely in place when the blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

Filters

All air filters are installed external to the unit. Filters should be inspected monthly. Clean or replace the filters when necessary to ensure proper furnace operation. Table 18 lists recommended filter sizes.

TABLE 18

Furnace Cabinet Width	Filter Size
17-1/2"	**16 x 25 x 1 (1)**
21"	

Exhaust and air intake pipes

Check the exhaust and air intake pipes and all connections for tightness and to make sure there is no blockage.

***NOTE** - After any heavy snow, ice or frozen fog event the furnace vent pipes may become restricted. Always check the vent system and remove any snow or ice that may be obstructing the plastic intake or exhaust pipes.*

Electrical

1 - Check all wiring for loose connections.
2 - Check for the correct voltage at the furnace (furnace operating). Correct voltage is 120VAC ± 10%
3 - Check amp-draw on the blower motor with blower access panel in place.
Motor Nameplate_____Actual_____

Check Motor AMP Draw
(Typical set–up with upflow furnace shown)

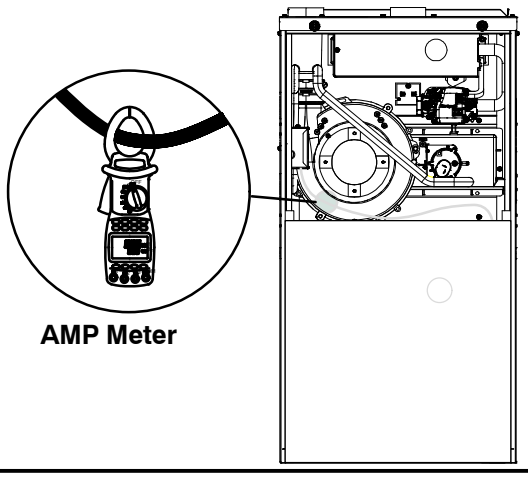


FIGURE 54

Winterizing and Condensate Trap Care

1 - Turn off power to the furnace.
2 - Have a shallow pan ready to empty condensate water.
3 - Remove the clean out cap from the condensate trap and empty water. Inspect the trap then reinstall the clean out cap.

Cleaning Heat Exchanger

If cleaning the heat exchanger becomes necessary, follow the below procedures and refer to figure 1 when disassembling unit. Use papers or protective covering in front of furnace while removing heat exchanger assembly.

1 - Turn off electrical and gas supplies to the furnace.
2 - Remove the furnace access panels.
3 - Disconnect the wires from the gas valve.
4 - Remove gas supply line connected to gas valve. Remove the burner box cover (if equipped) and remove gas valve/manifold assembly.
5 - Remove sensor wire from sensor. Disconnect 2-pin plug from the ignitor.
6 - Disconnect wires from flame roll-out switches.
7 - Loosen clamps at vent elbow. Disconnect condensate drain tubing from flue collar. and remove the vent elbow.
8 - Loosen clamps and remove combustion air intake flexible connector if equipped.
9 - Remove four burner box screws at the vestibule panel and remove burner box. Set burner box assembly aside.
***NOTE** - If necessary, clean burners at this time. Follow procedures outlined in Burner Cleaning section.*
10 - Mark and disconnect all combustion air pressure tubing from cold end header collector box.
11 - Mark and remove wires from pressure switch assembly. Remove pressure switch assembly. Keep tubing attached to pressure switch assembly.
12 - Disconnect the plug from the combustion air inducer. Remove two screws which secure combustion air inducer to collector box. Remove combustion air inducer assembly. Remove ground wire from vest panel.

13 - Remove electrical junction box from the side of the furnace.

14 - Disconnect condensate line from cold end header box. Remove cold end header box.

15 - Loosen clamps on exhaust and air intake pipe seal plate. Slide exhaust and intake pipes up and out to clear blower deck. Remove exhaust and air intake pipe seal plate.

16 - Mark and disconnect any remaining wiring to heating compartment components. Disengage strain relief bushing and pull wiring and bushing through the hole in the blower deck.

17 - Remove the primary limit from the vestibule panel.

18 - Remove two screws from the front cabinet flange at the blower deck. Spread cabinet sides slightly to allow clearance for removal of heat exchanger.

19 - Remove screws along vestibule sides which secure vestibule panel and heat exchanger assembly to cabinet. Remove two screws from blower rail which secure top heat exchanger flange. Remove heat exchanger from furnace cabinet.

20 - Back wash heat exchanger with soapy water solution or steam. **If steam is used it must be below 275°F (135°C) .**

21 - Thoroughly rinse and drain the heat exchanger. Soap solutions can be corrosive. Take care to rinse entire assembly.

22 - Reinstall heat exchanger into cabinet making sure that the clamshells of the heat exchanger assembly are engaged properly into the support bracket on the blower deck. Remove the indoor blower to view this area through the blower opening.

23 - Re-secure the supporting screws along the vestibule sides and top to the cabinet.

24 - Reinstall cabinet screws on front flange at blower deck.

25 - Reinstall the primary limit on the vestibule panel.

26 - Route heating component wiring through hole in blower deck and reinsert strain relief bushing.

27 - Reinstall electrical junction box.

28 - Reinstall exhaust and air intake pipe seal plate. Reinstall exhaust and air intake pipes and tighten clamps on pipe seal plate.

29 - Reinstall the cold end header box.

30 - Reinstall the combustion air inducer. Reconnect the combustion air inducer to the wire harness.

31 - Reinstall pressure switch assembly and reconnect pressure switch wiring.

32 - Carefully connect combustion air pressure switch tubing from pressure switches to proper ports on cold end header collector box.

33 - Reinstall condensate trap.

34 - Secure burner box assembly to vestibule panel using four existing screws. **Make sure burners line up in center of burner ports.**

35 - Reconnect exhaust piping and exhaust drain tubing.

36 - Reconnect flame roll-out switch wires.

37 - Reconnect sensor wire and reconnect 2-pin plug from ignitor.

38 - Reinstall gas valve manifold assembly. Reconnect gas supply line to gas valve.

39 - Reinstall burner box cover if equipped.

40 - Reconnect plug to gas valve.

41 - Replace the blower compartment access panel.

42 - Follow lighting instructions on unit nameplate to light and operate furnace for 5 minutes to ensure the furnace is operating properly.

43- Check all piping connections, factory and field, for gas leaks. Use a leak detecting solution or other preferred means.

⚠ CAUTION

Some soaps used for leak detection are corrosive to certain metals. Carefully rinse piping thoroughly after leak test has been completed. Do not use matches, candles, flame or other sources of ignition to check for gas leaks.

44 - Replace access panel.

Cleaning the Burner Assembly (if needed)

1 - Turn off electrical and gas power supplies to furnace. Remove upper and lower furnace access panels.

2 - Disconnect the 2-pin plug from the gas valve.

3 - Remove the burner box cover (if equipped).

4 - Disconnect the gas supply line from the gas valve. Remove gas valve/manifold assembly.

5 - -Loosen clamps and remove combustion air intake flexible connector (if equipped).

5 - Mark and disconnect sensor wire from the sensor. Disconnect plug from the ignitor at the burner box.

6 - Remove four screws which secure burner box assembly to vest panel. Remove burner box from the unit.

7 - Use the soft brush attachment on a vacuum cleaner to gently clean the face of the burners. Visually inspect the inside of the burners and crossovers for any blockage caused by foreign matter. Remove any blockage.

8 - Reinstall the burner box assembly using the existing four screws. Make sure that the burners line up in the center of the burner ports.

9 - Reconnect the sensor wire and reconnect the 2-pin plug to the ignitor wiring harness.

10 - Reinstall combustion air intake flexible connector (if equipped), secure using existing clamps.

11 - Reinstall the gas valve manifold assembly. Reconnect the gas supply line to the gas valve. Reinstall the burner box cover.

12 - Reconnect plug to gas valve.

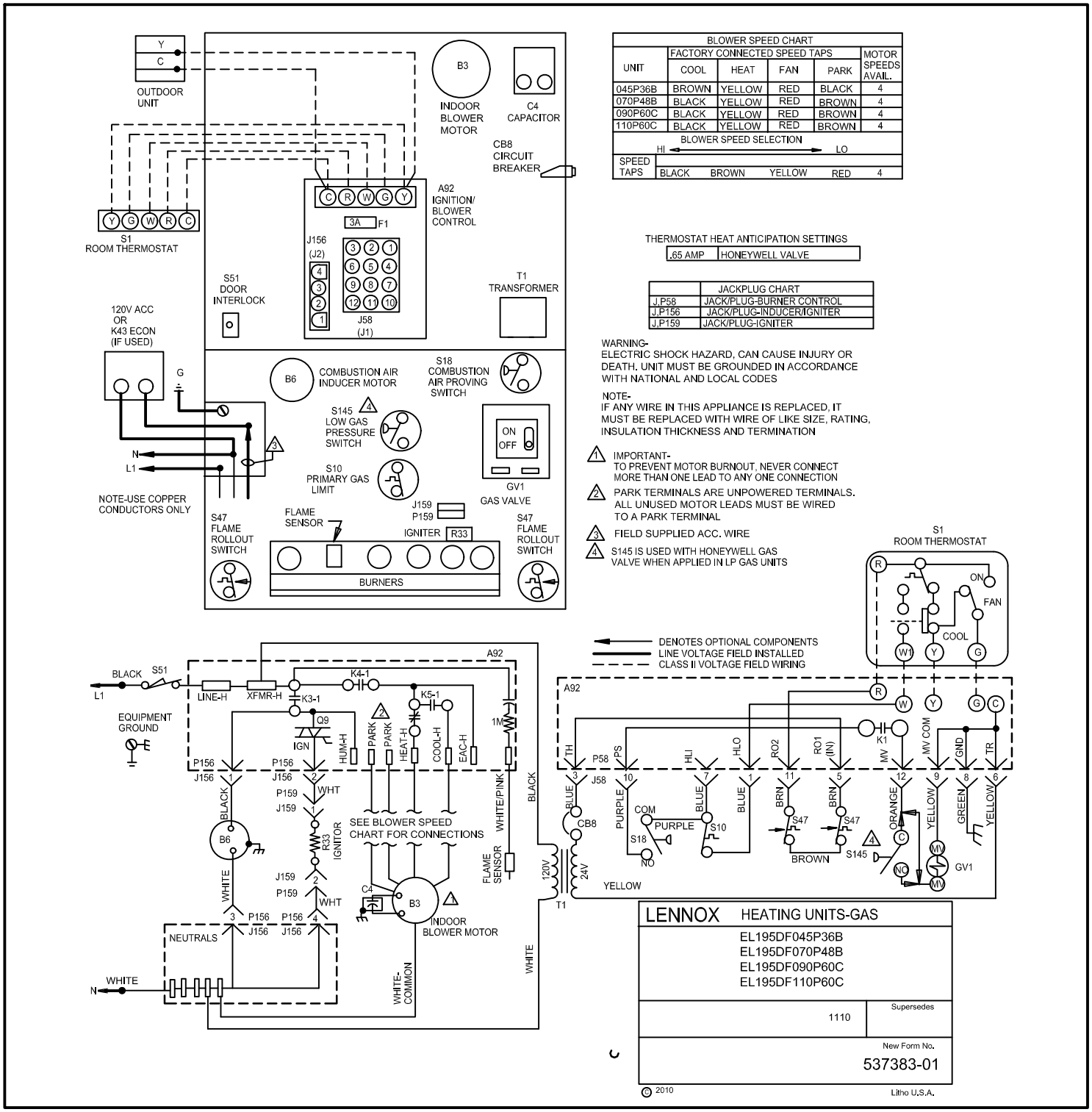
13 - Replace the blower compartment access panel.

14 - Refer to instruction on verifying gas and electrical connections when re-establishing supplies.

15 - Follow lighting instructions to light and operate furnace for 5 minutes to ensure that heat exchanger is clean and dry and that furnace is operating properly.

16 - Replace access panel.

VII-WIRING DIAGRAM AND SEQUENCE OF OPERATION



1 - When there is a call for heat, W1 of the thermostat energizes W of the furnace control with 24VAC.

2 - S10 primary limit switch and S47 rollout switch are closed. Call for heat can continue.

3 - The integrated contol (A92) energizes combustion air inducer B6. Combustion air inducer runs until S18 combustion air prove switch closes (switch must close within 2-1/2 minutes or control goes into 5 minute Watchguard Pressure Switch delay). Once S18 closes, a 15-second pre-purge follows.

4 - The integrated control (A92) energizes ignitor. A 20-second warm-up period begins.

5 - Gas valve opens for a 4-second trial for ignition

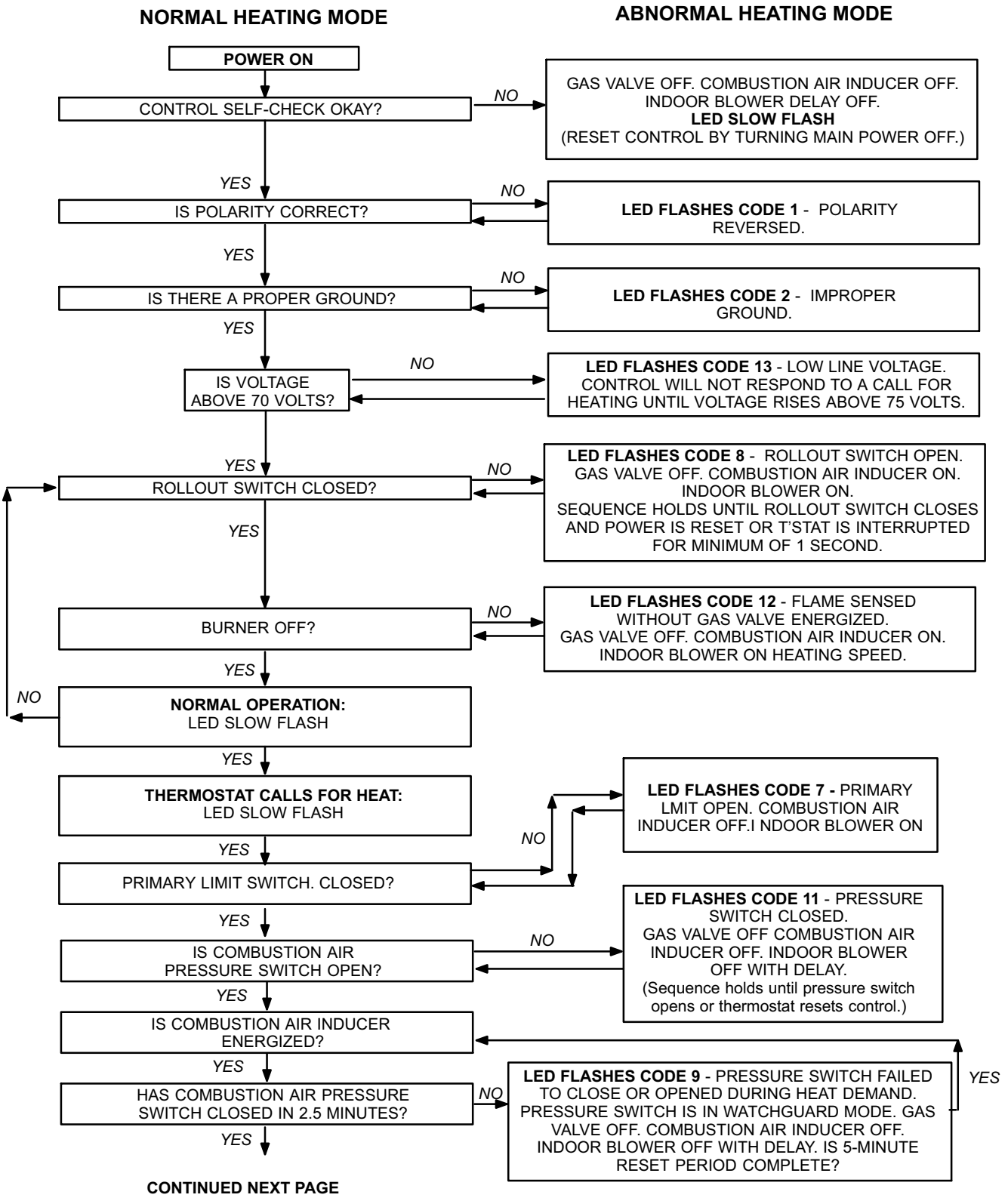
6 - Flame is sensed, gas valve remains open for the heat call.

7 - After 30-second delay, the integrated control (A92) energizes indoor blower B3.

8 - When heat demand is satisfied, W1 of the indoor thermostat de-energizes W of the integrated control which de-energizes the gas valve. Combustion air inducer B6 continues a 5-second post-purge period, and indoor blower B3 completes a selected OFF time delay.

Troubleshooting: Heating Sequence of Operation

HEATING SEQUENCE OF OPERATION


NORMAL HEATING MODE
ABNORMAL HEATING MODE
POWER ON
CONTROL SELF-CHECK OKAY?
NO
GAS VALVE OFF. COMBUSTION AIR INDUCER OFF.
INDOOR BLOWER DELAY OFF.
LED SLOW FLASH
(RESET CONTROL BY TURNING MAIN POWER OFF.)
YES
IS POLARITY CORRECT?
NO
LED FLASHES CODE 1 - POLARITY REVERSED.
YES
IS THERE A PROPER GROUND?
NO
LED FLASHES CODE 2 - IMPROPER GROUND.
YES
IS VOLTAGE ABOVE 70 VOLTS?
NO
LED FLASHES CODE 13 - LOW LINE VOLTAGE. CONTROL WILL NOT RESPOND TO A CALL FOR HEATING UNTIL VOLTAGE RISES ABOVE 75 VOLTS.
YES
ROLLOUT SWITCH CLOSED?
NO
LED FLASHES CODE 8 - ROLLOUT SWITCH OPEN. GAS VALVE OFF. COMBUSTION AIR INDUCER ON. INDOOR BLOWER ON. SEQUENCE HOLDS UNTIL ROLLOUT SWITCH CLOSES AND POWER IS RESET OR T'STAT IS INTERRUPTED FOR MINIMUM OF 1 SECOND.
YES
BURNER OFF?
NO
LED FLASHES CODE 12 - FLAME SENSED WITHOUT GAS VALVE ENERGIZED. GAS VALVE OFF. COMBUSTION AIR INDUCER ON. INDOOR BLOWER ON HEATING SPEED.
YES
NO
NORMAL OPERATION:
LED SLOW FLASH
YES
THERMOSTAT CALLS FOR HEAT:
LED SLOW FLASH
NO
LED FLASHES CODE 7 - PRIMARY LMIT OPEN. COMBUSTION AIR INDUCER OFF.I NDOOR BLOWER ON
YES
PRIMARY LIMIT SWITCH. CLOSED?
YES
IS COMBUSTION AIR PRESSURE SWITCH OPEN?
NO
LED FLASHES CODE 11 - PRESSURE SWITCH CLOSED. GAS VALVE OFF COMBUSTION AIR INDUCER OFF. INDOOR BLOWER OFF WITH DELAY. (Sequence holds until pressure switch opens or thermostat resets control.)
YES
IS COMBUSTION AIR INDUCER ENERGIZED?
YES
HAS COMBUSTION AIR PRESSURE SWITCH CLOSED IN 2.5 MINUTES?
NO
LED FLASHES CODE 9 - PRESSURE SWITCH FAILED TO CLOSE OR OPENED DURING HEAT DEMAND. PRESSURE SWITCH IS IN WATCHGUARD MODE. GAS VALVE OFF. COMBUSTION AIR INDUCER OFF. INDOOR BLOWER OFF WITH DELAY. IS 5-MINUTE RESET PERIOD COMPLETE?
YES
YES
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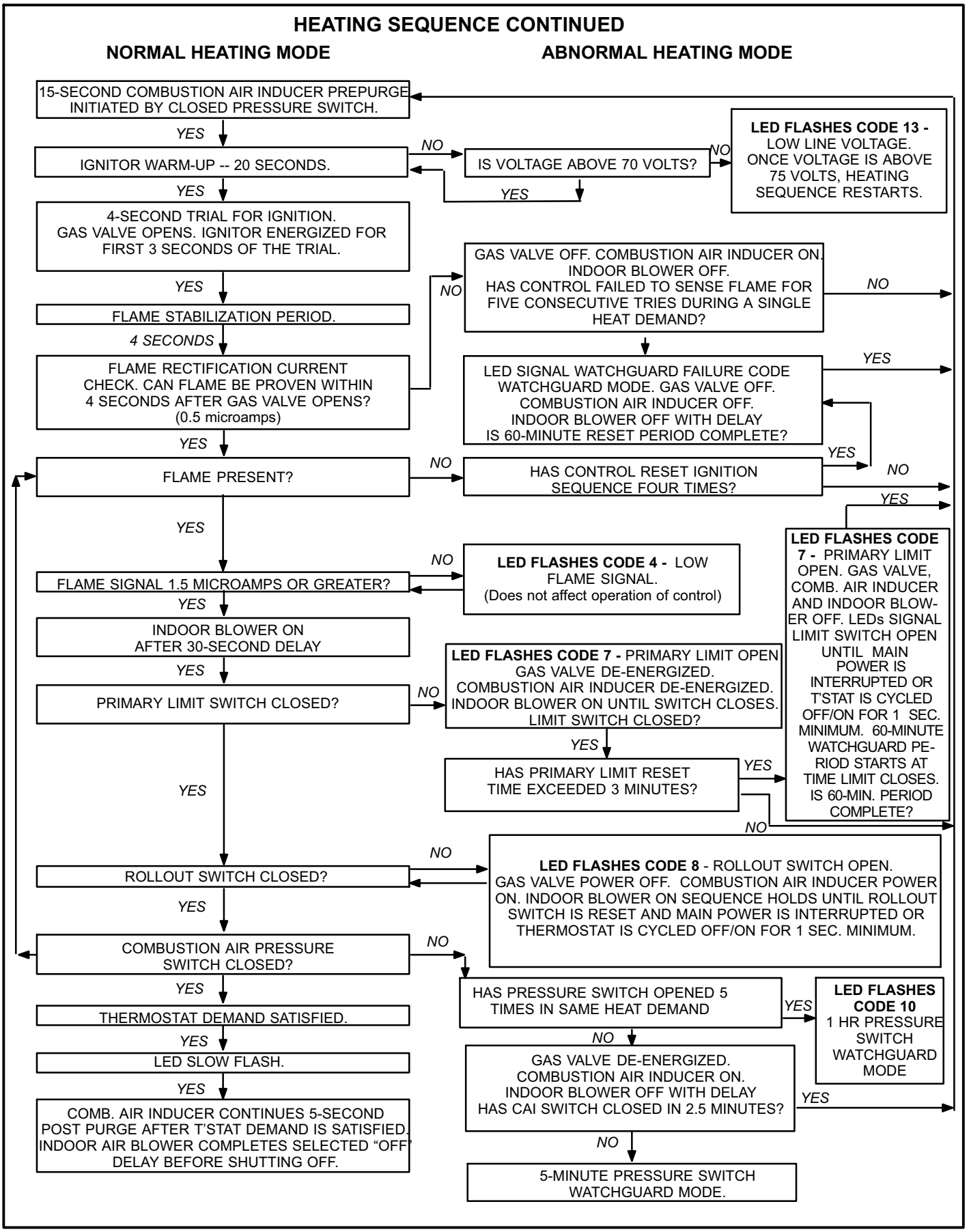
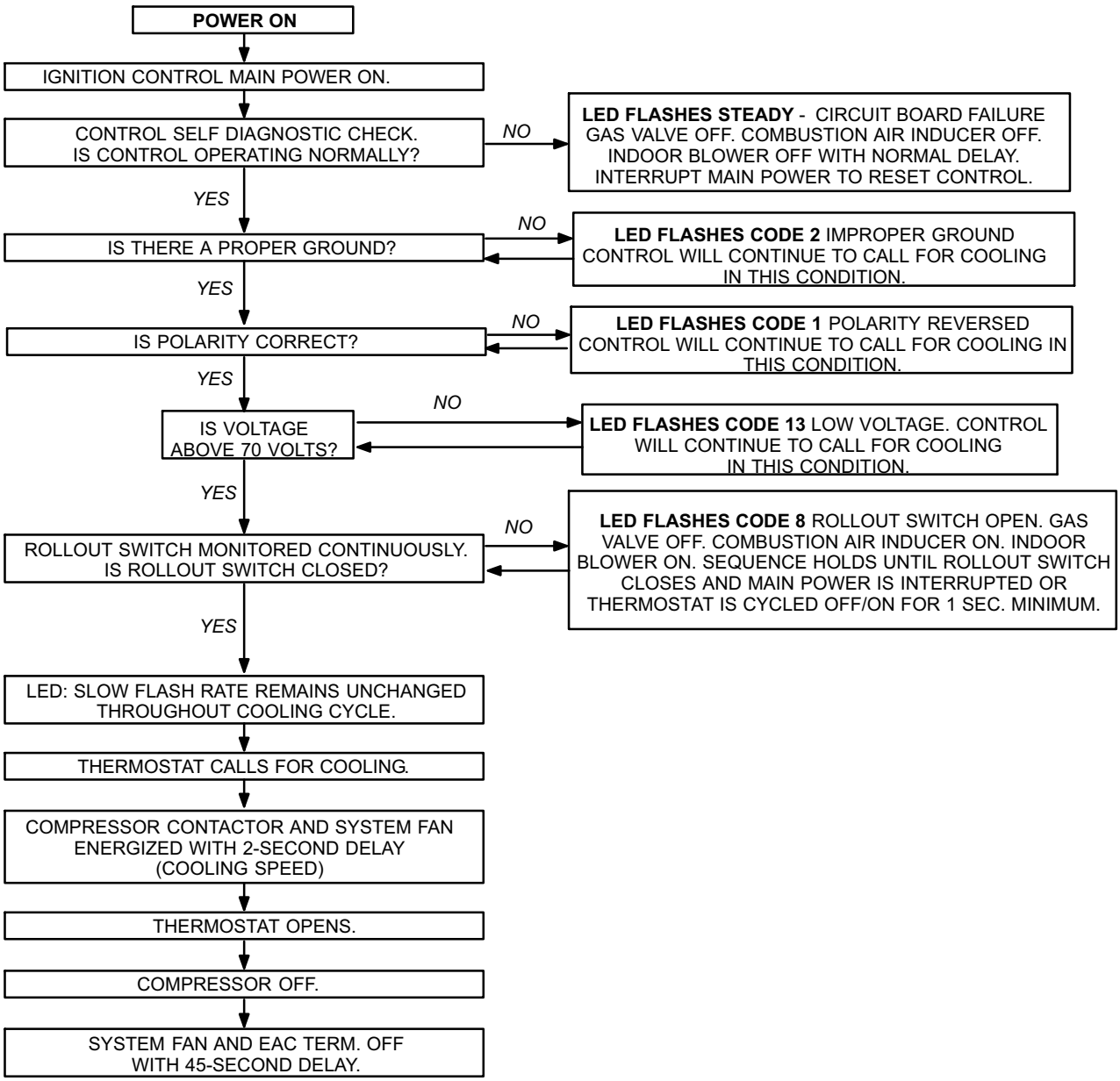

HEATING SEQUENCE CONTINUED
NORMAL HEATING MODE
ABNORMAL HEATING MODE
15-SECOND COMBUSTION AIR INDUCER PREPURGE INITIATED BY CLOSED PRESSURE SWITCH.
YES
IGNITOR WARM-UP -- 20 SECONDS.
NO
IS VOLTAGE ABOVE 70 VOLTS?
NO
YES
LED FLASHES CODE 13 - LOW LINE VOLTAGE. ONCE VOLTAGE IS ABOVE 75 VOLTS, HEATING SEQUENCE RESTARTS.
YES
4-SECOND TRIAL FOR IGNITION. GAS VALVE OPENS. IGNITOR ENERGIZED FOR FIRST 3 SECONDS OF THE TRIAL.
YES
FLAME STABILIZATION PERIOD.
4 SECONDS
FLAME RECTIFICATION CURRENT CHECK. CAN FLAME BE PROVEN WITHIN 4 SECONDS AFTER GAS VALVE OPENS? (0.5 microamps)
NO
GAS VALVE OFF. COMBUSTION AIR INDUCER ON. INDOOR BLOWER OFF. HAS CONTROL FAILED TO SENSE FLAME FOR FIVE CONSECUTIVE TRIES DURING A SINGLE HEAT DEMAND?
NO
YES
LED SIGNAL WATCHGUARD FAILURE CODE WATCHGUARD MODE. GAS VALVE OFF. COMBUSTION AIR INDUCER OFF. INDOOR BLOWER OFF WITH DELAY IS 60-MINUTE RESET PERIOD COMPLETE?
YES
YES
FLAME PRESENT?
NO
HAS CONTROL RESET IGNITION SEQUENCE FOUR TIMES?
NO
YES
YES
FLAME SIGNAL 1.5 MICROAMPS OR GREATER?
NO
LED FLASHES CODE 4 - LOW FLAME SIGNAL. (Does not affect operation of control)
YES
INDOOR BLOWER ON AFTER 30-SECOND DELAY
YES
PRIMARY LIMIT SWITCH CLOSED?
NO
LED FLASHES CODE 7 - PRIMARY LIMIT OPEN GAS VALVE DE-ENERGIZED. COMBUSTION AIR INDUCER DE-ENERGIZED. INDOOR BLOWER ON UNTIL SWITCH CLOSES. LIMIT SWITCH CLOSED?
YES
HAS PRIMARY LIMIT RESET TIME EXCEEDED 3 MINUTES?
YES
LED FLASHES CODE 7 - PRIMARY LIMIT OPEN. GAS VALVE, COMB. AIR INDUCER AND INDOOR BLOWER OFF. LEDs SIGNAL LIMIT SWITCH OPEN UNTIL MAIN POWER IS INTERRUPTED OR T'STAT IS CYCLED OFF/ON FOR 1 SEC. MINIMUM. 60-MINUTE WATCHGUARD PERIOD STARTS AT TIME LIMIT CLOSES. IS 60-MIN. PERIOD COMPLETE?
NO
YES
NO
ROLLOUT SWITCH CLOSED?
NO
LED FLASHES CODE 8 - ROLLOUT SWITCH OPEN. GAS VALVE POWER OFF. COMBUSTION AIR INDUCER POWER ON. INDOOR BLOWER ON SEQUENCE HOLDS UNTIL ROLLOUT SWITCH IS RESET AND MAIN POWER IS INTERRUPTED OR THERMOSTAT IS CYCLED OFF/ON FOR 1 SEC. MINIMUM.
YES
COMBUSTION AIR PRESSURE SWITCH CLOSED?
NO
HAS PRESSURE SWITCH OPENED 5 TIMES IN SAME HEAT DEMAND
YES
LED FLASHES CODE 10 1 HR PRESSURE SWITCH WATCHGUARD MODE
YES
THERMOSTAT DEMAND SATISFIED.
YES
LED SLOW FLASH.
YES
COMB. AIR INDUCER CONTINUES 5-SECOND POST PURGE AFTER T'STAT DEMAND IS SATISFIED. INDOOR AIR BLOWER COMPLETES SELECTED "OFF" DELAY BEFORE SHUTTING OFF.
NO
GAS VALVE DE-ENERGIZED. COMBUSTION AIR INDUCER ON. INDOOR BLOWER OFF WITH DELAY HAS CAI SWITCH CLOSED IN 2.5 MINUTES?
YES
NO
5-MINUTE PRESSURE SWITCH WATCHGUARD MODE.

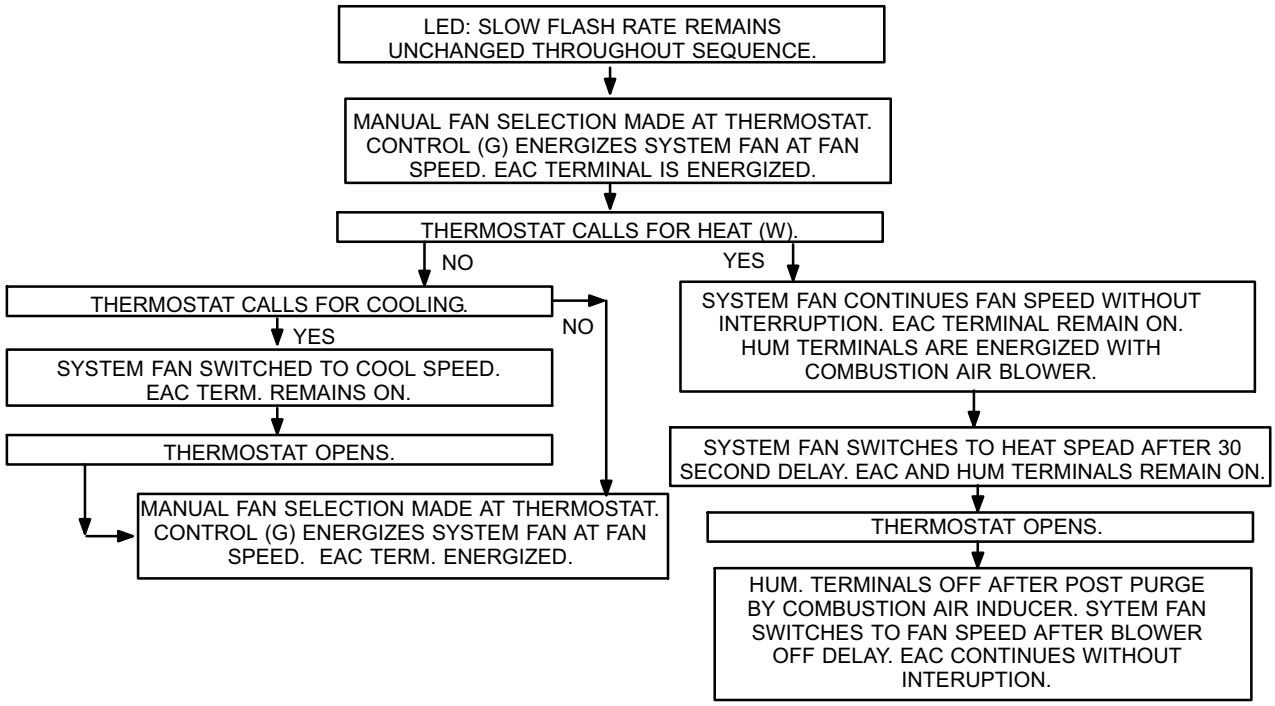
Troubleshooting: Cooling Sequence of Operation

COOLING SEQUENCE OF OPERATION


NORMAL COOLING MODE
ABNORMAL COOLING MODE
POWER ON
IGNITION CONTROL MAIN POWER ON.
CONTROL SELF DIAGNOSTIC CHECK. IS CONTROL OPERATING NORMALLY?
NO
LED FLASHES STEADY - CIRCUIT BOARD FAILURE GAS VALVE OFF. COMBUSTION AIR INDUCER OFF. INDOOR BLOWER OFF WITH NORMAL DELAY. INTERRUPT MAIN POWER TO RESET CONTROL.
YES
IS THERE A PROPER GROUND?
NO
LED FLASHES CODE 2 IMPROPER GROUND CONTROL WILL CONTINUE TO CALL FOR COOLING IN THIS CONDITION.
YES
IS POLARITY CORRECT?
NO
LED FLASHES CODE 1 POLARITY REVERSED CONTROL WILL CONTINUE TO CALL FOR COOLING IN THIS CONDITION.
YES
IS VOLTAGE ABOVE 70 VOLTS?
NO
LED FLASHES CODE 13 LOW VOLTAGE. CONTROL WILL CONTINUE TO CALL FOR COOLING IN THIS CONDITION.
YES
ROLLOUT SWITCH MONITORED CONTINUOUSLY. IS ROLLOUT SWITCH CLOSED?
NO
LED FLASHES CODE 8 ROLLOUT SWITCH OPEN. GAS VALVE OFF. COMBUSTION AIR INDUCER ON. INDOOR BLOWER ON. SEQUENCE HOLDS UNTIL ROLLOUT SWITCH CLOSES AND MAIN POWER IS INTERRUPTED OR THERMOSTAT IS CYCLED OFF/ON FOR 1 SEC. MINIMUM.
YES
LED: SLOW FLASH RATE REMAINS UNCHANGED THROUGHOUT COOLING CYCLE.
THERMOSTAT CALLS FOR COOLING.
COMPRESSOR CONTACTOR AND SYSTEM FAN ENERGIZED WITH 2-SECOND DELAY (COOLING SPEED)
THERMOSTAT OPENS.
COMPRESSOR OFF.
SYSTEM FAN AND EAC TERM. OFF WITH 45-SECOND DELAY.

Troubleshooting: Continuous Fan / Accessories Sequence of Operation

CONTINUOUS FAN / ACCESSORIES SEQUENCE OF OPERATION


LED: SLOW FLASH RATE REMAINS UNCHANGED THROUGHOUT SEQUENCE.
MANUAL FAN SELECTION MADE AT THERMOSTAT. CONTROL (G) ENERGIZES SYSTEM FAN AT FAN SPEED. EAC TERMINAL IS ENERGIZED.
THERMOSTAT CALLS FOR HEAT (W).
NO
YES
THERMOSTAT CALLS FOR COOLING.
NO
YES
SYSTEM FAN SWITCHED TO COOL SPEED. EAC TERM. REMAINS ON.
THERMOSTAT OPENS.
MANUAL FAN SELECTION MADE AT THERMOSTAT. CONTROL (G) ENERGIZES SYSTEM FAN AT FAN SPEED. EAC TERM. ENERGIZED.
SYSTEM FAN CONTINUES FAN SPEED WITHOUT INTERRUPTION. EAC TERMINAL REMAIN ON. HUM TERMINALS ARE ENERGIZED WITH COMBUSTION AIR BLOWER.
SYSTEM FAN SWITCHES TO HEAT SPEAD AFTER 30 SECOND DELAY. EAC AND HUM TERMINALS REMAIN ON.
THERMOSTAT OPENS.
HUM. TERMINALS OFF AFTER POST PURGE BY COMBUSTION AIR INDUCER. SYTEM FAN SWITCHES TO FAN SPEED AFTER BLOWER OFF DELAY. EAC CONTINUES WITHOUT INTERUPTION.